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## ELECTRICAL EXPORTS IN 1905.

There is every probability that the electrical export trade of the United States reached a mark well over $12,000,000 in 1905. The full returns for last year are not yet available, December being still unreported, but the eleven months reached a total which at the same ratio would bring the figure for the year up to about $12,551,370, of which $5,411,550 would be in general electrical apparatus and instruments and $7,139,820 in heavy electrical machinery and motors. The eleven months showed in apparatus and instruments a notable gain over 1904, being $4,963,010, against $3,930,311, while electrical machinery also exhibited a gain, being for the eleven months not less than $6,568,950, against $6,071,920.

Such statistics, already noted in these pages, from month to month, are very gratifying to all of us who have sought to promote and develop this electrical export trade, and must be encouraging to manufacturers who have been seeking new outlets for their productions. We had feared that the enormous development of the home market during the past year would have checked exports by rendering the manufacturer indifferent to foreign demand; but evidently this is not the case, or else the customer abroad with his taste cultivated for American electrical goods would not be denied by delay nor deterred by price. As a matter of fact the gain of the year seems to be pretty well distributed, although growth is shown more particularly in the exports to the United Kingdom, Japan, Mexico and British North America.

If the production of electrical apparatus be taken, as it must, at about $200,000,000, or slightly over, then the export is not more than 5 or 6 per cent of the total. This is surely susceptible of increase, and a business of $1,000,000 per month affords an excellent foundation for larger trade. In this respect we desire to call attention to the article by Mr. Geissel in this issue, in which he analyzes export conditions and offers many suggestions as to new channels and fresh fields.

## THE GAS TURBINE.

The success of the steam turbine has quite naturally brought forward consideration of the possibility of a similar development in the means for transforming the heat of gas into mechanical energy, and the discussion of the broad outline of the problem thus presented may not be without interest. Putting the matter briefly, we may split up the efficiency of any form of heat prime mover into four factors: (a) The ideal thermal efficiency, dependent primarily on the cycle employed and on the operative range of temperature. (b) The operative efficiency, or fraction of this ideal which can be realized in practice. (c) The conversion efficiency, or ratio of available molecular energy resulting from the combination of (a) and (b) which is finally transformed into mechanical work and embodied in the moving part of the prime mover. (d) The mechanical efficiency or fraction of energy converted which reaches the point of delivery, at the

engine shaft. Now for the gas engine, the factor (a) is the highest of any present known type of prime-mover. The factor (b) is moderate to low; the factor (c) is high, practically 100 per cent in all piston prime movers; and the factor (d) whatever the mechanical construction may determine, but usually not below .85. The gas turbine, on the other hand, has a lower value of (a) simply because it cannot be operated under a continuous intake temperature as high as the intermittent values reached at the instants of explosion in the reciprocating type. The (b) factor is also moderate to low; the (c) factor, representing the efficiency of conversion by the vanes from jet energy to mechanical work at the rotor, is also moderate or low, probably not above .75; while the (d) factor may be somewhat higher than for the reciprocating type.

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Detailed discussion of these points is aside from present purposes, but it may be said that these differences seem to be inherent in the nature of things, and it is difficult to see how the gas turbine can be made to rival in final efficiency the present standards realized by the reciprocating type. Various combinations are also held in view by engineers and inventors—steam and gas; gas and steam, reciprocating; gas engines and gas-steam turbines in tandem. In varying combinations these elements are being passed in review in the hope that some combination may spell success. It seems indeed probable that some such combination may show reasonably good efficiency, but it seems very unlikely that it will rival that of the reciprocating internal combustion motor. At the best, therefore, we may have a choice, so far as these two are concerned, between a reciprocating engine of high efficiency and a turbine combination of low or moderate efficiency. It would seem well assured, therefore, wherever the mechanical conditions are such as to permit the use of a reciprocating prime-mover, that the gas engine will not be displaced by the gas turbine, either in its simple form or in any of its possible complex or combination forms.

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## The Flaming Arc.

This new illuminant is becoming a somewhat common sight in the larger cities, although it is still enough of a rarity to cause picturesque comment. The wonder is that the lamp has taken so long a time to make its way in this country, it having been pretty well known abroad for several years. The whole subject was thoroughly aired in an admirable paper by M. Blondel at the International Electrical Congress of 1904, and perhaps this introduction more than anything else served to call attention to the importance of the innovation. Be that as it may, the flaming arc is now with us and probably to stay. Its appearance is somewhat startling, even to a hardened technologist. It looms up from the street like a compressed conflagration, making the ordinary arcs look like blue candles, while the gas lights and ordinary incandescents have beside it about the apparent luminosity of a white bean. The splendid pale golden hue of the light looks queer at first to the eye that has gradually become accustomed to the bluish light of the enclosed arcs, but the effect, save for the unpleasantly great brilliancy, is altogether good. The common globe is totally unfitted for dealing with a source of so enormous brilliancy and should be replaced by a very strongly diffusing globe of at least double the ordinary diameter.

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The loss of light thus incurred is a very trivial matter, considering the enormous efficiency of the flaming arc. To put the facts conservatively it gives five to ten times as much light per watt as the common enclosed arc. Blondel for the naked flaming arc gives figures down to 0.125 watt per candle—not mean horizontal candles, either, nor again that uncanny thing devised to hide bad distribution, the downward hemispherical candle-power—but good, unequivocal, mean spherical candles. For the first time in the history of electric lighting one sees in commercial use on the streets lamps that can be rated at 2,000 candle-power without the need of any photometric apologies. It is not to be assumed that the flaming arcs as we see them are working at the tremendous efficiency cited by Blondel, but they completely outclass any other illuminant of human devising so far as efficiency is concerned.

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Unhappily, all of the flaming arcs as yet devised give off fumes in sufficient quantity to make them undesirable for ordinary use indoors. For street use, however, they are well adapted, save for the extra care required. Just what this will in practice amount to is at present uncertain. The consumption of electrode amounts to from three-quarters of an inch to an inch per hour, which permits all-night burning comfortably enough, but demands daily trimming. This puts them in the class of the old open arcs as regards attendance, and the carbons themselves, as well as the lamps, are just now relatively quite expensive. The greatly reduced energy required for a given light goes so far to compensate these expenses, that the flaming arc is quite certain to take rank as the cheapest known illuminant. Up to the present time that distinction has belonged to the so-called gas arc, the cost of which, however, is sufficiently near to that of the electric arc as to render it certain that the flaming arc will form a class by itself.

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The flaming arc must undoubtedly be the subject of a great deal of experimentation before its idiosyncracies are as well understood as those of the ordinary arc. Much work has already been done on it abroad, and if this is not neglected, as it too often is, by our countrymen, the experimental period here will not, we think, be very burdensome. The central stations have not taken up the matter very vigorously, and there will certainly be some hesitation in pushing it on account of its enormous efficiency, which is enough to make any self-respecting meter look for another job. As a defence against the inroads of the gas arc, however, it has an immediate value to the central station, which will be greatly enhanced if it can be, as will probably happen, adapted for indoor use. It would be hard to imagine any more economical or effective illumination for large interiors than diffusive lighting with the flaming arc for a radiant. Capable as it is of considerable variation in color, the resulting effects would be of great beauty and interest. As the situation now appears, indoor lighting is the goal toward which the flaming arc should be forced. Once there the present competition with gas would take on a very different phase. The business of electric lighting is at present in a condition that does not warrant the shelving of improvements. A group of new illuminants is arriving and should be treated with becoming courtesy. It is no time to sit down and figure out devices for screwing up the charges against improved illuminants. That policy will inevitably prove a boomerang which no agility will enable the thrower to dodge. If the users of light had no other sources of information, the gas companies would see that they did not remain in ignorance despite the danger of competition. How many Welsbachs would be in use to-day if the gas companies schemed devious ways to double the price of gas when used in them, or insisted on fur-

nishing them and ate up the economies in their replacement charges? In the long run improvements pay, and the issue must be squarely met.

## THE CATHODE RAY OSCILLOGRAPH.

The last number of the *Physical Review* contains a paper by Mr. R. Rankin upon the "Use of a Magnetic Field with the Ryan Cathode-ray Oscillograph." A remarkable and interesting phenomenon is described in the paper. The cathode-ray oscillograph consists, as is generally known, of a special form of cathode-ray vacuum tube made in Germany. In shape it is something like a bottle with a long neck; but, having a hemispherical base, it has to be side supported. In the long neck there is a cathode disc, at the end which would correspond to the cork of a bottle, and about fifteen centimeters down the neck, in a little side pocket, is placed the wire anode. Where the neck joins the bulb there is a metallic diaphragm, with a small hole in the center. When the tube is excited by connecting it to a suitable high-voltage source, cathode rays are thrown out by the cathode, down the neck of the bottle, and a large number of them strike the diaphragm. Here they are absorbed, or reflected, except at the small hole, where they project down into the bulb of the bottle. The diaphragm serves, therefore, to direct a small beam of parallel cathode rays unimpeded down the axis of the bottle to the middle of the base. The bulb contains at the base a transverse screen of calcium sulphide on mica, which in a darkened room lights up by phosphorescence at the central spot where the beam strikes. The beam is about eighty centimeters in length, the pierced diaphragm being placed at about the middle of that length. So long as no transverse magnetic or electric forces act upon the beam, the spot of phosphorescent light remains stationary at the center of the translucent screen. If, however, an alternating electromagnetic flux passes across the neck of the bottle below the diaphragm, the beam will be alternately deflected to the right and left, without sensible inertia or loss of time, and will appear to form a luminous straight line on the phosphorescent screen. By combining the actions of two separate alternating magnetic fluxes at right angles to each other, acting successively on the axial beam, the beam can be made to execute a closed curve or loop on the screen. From the shape of the curve the wave forms of the two electromagnetic fluxes can be inferred. Thus, if both fluxes are sinusoidal, the loop formed by the beam will be some ellipse. If one is made sinusoidal, while the other is irregular, the wave shape of the latter is deducible from the shape of the loop.

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It is found that when a short solenoid or coil is placed on the neck of the bottle, with its axis coincident with the bottle axis, the spot of light on the screen is intensified and steadied. Consequently, three magnetic fluxes are used in the most recent form of the apparatus, one parallel to the axis, and applied behind the diaphragm to straighten and collimate the beam of cathode rays incident on the diaphragm; while the other two are applied across the beam, and mutually perpendicular, like the cross hairs of a telescope, but not in the same plane, the beam first being deflected by one and then by the other. It was observed that when the first or axial and collimating flux was applied, the voltage across the tube was markedly affected. The effect has been noticed by several observers, in cathode-ray tubes not designed for oscillographic purposes. It was supposed that the axial magnetic field altered the character of the discharge in the tube and thus altered the voltage. When a tube is exhausted to the high degree necessary for the production of cathode rays, the voltage which must be applied in order to excite the discharge becomes considerable. The continued use of a cathode-ray tube, moreover, tends to perfect the vacuum and to call for a yet higher voltage. In the case of the tube described in the paper, the initial e.m.f. was 17.5 kilovolts. When the solenoid on the neck was excited to 500 ampere-turns, the e.m.f. was still sensibly constant at 17.5 kilovolts; but when the m.m.f. of the solenoid was increased gradually to 1,000 ampere-turns the e.m.f. on the tube fell steadily to 10 kilovolts. During this change neither the current strength of the discharge, nor the character of the discharge, as apparent to the eye, underwent any sensible modification. In other words, turning on the axial field reduced the c.e.m.f. offered by the tube to the discharge and, therefore, reduced the power consumed by the discharge. The effect was found to continue beyond, until 7,000 ampere-turns was applied to the coil, the maximum reported. At that m.m.f. the tube voltage had fallen, by irregular steps, to 7 kilovolts, or to considerably less than half the initial value, which was restored on removing the m.m.f. Similar experiments were tried at a time when the initial tube voltage was 24 kilovolts. This also fell to 7 kilovolts on applying the full 7,000 ampere-turns to the solenoid. The effect was substantially the same with either direction of the exciting current and magnetic flux.

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The explanation of this remarkable effect has not yet been made clear. The writer of the paper attributes the effect to a secondary influence. When the axial magnetic field is applied, the cathode rays are prevented from diverging laterally, and are lined up into a parallel beam along the tube, so that the great majority hit the diaphragm placed across the neck. When the axial field is removed, the cathode rays are more dispersed, or scatter, and large numbers hit the sides of the tube. It is supposed that these scattered rays produce in some way a marked c.e.m.f., which has to be overcome by the discharge. The straightening of the stream into a parallel bundle, in preventing the walls of the neck from being struck by large numbers of the cathode-ray projectiles, serves, according to the suggestion, to eliminate this secondary c.e.m.f. The idea is also suggested that the scattered rays which hit the walls of the neck rebound and return upon the main stream, in such a way as to increase the c.e.m.f., or make an increase necessary in the e.m.f. in order to carry on the discharge. The explanation thus offered seems incomplete and unsatisfactory.. The fact remains that although the maximum field strength produced by the solenoid is inside its length, and, therefore, at a distance of about 15 centimeters from the anode, or 30 from the cathode, yet there would be a very appreciable axial magnetic field at each of these electrodes. That is to say, the two electrodes in the experiment were exposed to a certain lesser strength of axial magnetic field. The effect may have been due, therefore, at least in part, to actions on the magnetized surfaces of the electrodes. It would seem that only when the two electrodes are completely shielded from the field produced by such a solenoid, can the effect be clearly confined to secondary actions of cathode rays, as distinguished from the action of the field on the electrodes. On the other hand, however, an experiment, mentioned in the paper, with a small horseshoe magnet which, when acting above the diaphragm so as virtually to occlude the central hole, perceptibly increased the tube voltage, certainly favors the suggestion of indirect action. It is to be hoped that the matter will be fully investigated experimentally by many observers. It has both theoretical and practical importance.

## Westinghouse Single-Phase Equipment for the Sarnia Tunnel

An important contract has just been made between the St. Clair Tunnel Company and the Westinghouse Electric & Manufacturing Company for a complete single-phase installation to operate freight and passenger trains through the Sarnia tunnel, which connects the American and Canadian divisions of the Grand Trunk Railway system of Montreal, Canada. The plans and specifications were prepared by Mr. Bion J. Arnold, of Chicago, whose pioneer work in single-phase, alternating-current traction is well known, and the work of installation will be conducted under his supervision.

The equipment includes a complete power station with steam turbines, bridge and pole lines for catenary trolley construction, overhead work, transformers for power and light, round house motors, motor-driven pumps, drainage and sewer systems for buildings and yards, electric locomotives, etc. Interest centers, of course, largely in the locomotives equipped with the series-wound, single-phase motors developed by the Westinghouse Company. There are to be six similar units designed to meet the requirements of the tunnel service of the Grand Trunk Railway. Each will exert a drawbar pull of 25,000 lb. on a 2 per cent grade at a speed of 10 miles per hour. The locomotives may be operated from either end, and two or more may be coupled together and controlled in multiple from a single unit, so that there is practically no limit to the size of train which may be taken through the tunnel by the electrical equipment—other than that imposed by the limited mechanical strength of the coupling which joins car to car.

These locomotives are of the rigid frame type, with driving axle boxes and draft gear mounted on the same frame. Each unit will have three pairs of 62-in. driving wheels with a motor on each axle connected with a gear reduction of 18 to 95. It will weigh approximately 62 tons, all of which is on the driving wheels. Equalizer beams similar to those used in standard steam locomotive practice will distribute the weight among the six drivers. The frames will be made of cast steel and will be placed outside the wheels. The locomotives will be equipped with the Westinghouse friction draft gear. The power equipment of each unit comprises three 250-hp, single-phase, series-wound motors of the same general type as those recently adopted by the New York, New Haven & Hartford Railroad for their terminal operations in New York. Pneumatically-operated trolleys of the pantagraph type will collect the current from the overhead trolley line outside the tunnel.

The Sarnia tunnel of the St. Clair Tunnel Company passes under the St. Clair River and connects the divisions of the Grand Trunk Railway system which terminate at Port Huron, Mich., and Sarnia, Ont. The tunnel proper is 6,032 ft. long. A single track leads through the tunnel, but the approaches are double track to a point about 300 ft. from each portal. From terminal to terminal, a distance of 19,348 ft., will be electrically equipped. At the present time passenger and freight trains arriving from either direction are hauled through the tunnel by steam locomotives. Almost all of the freight trains must on arrival be divided, as they are too heavy for a single locomotive. The result has been that traffic is congested at the terminals and the entire service of the system impaired. It is expected that the electric locomotives will greatly relieve this congestion, as their greater capacity and flexibility will eliminate or largely reduce the necessity of dividing trains.

Alternating current at 3,000 volts, 25 cycles, will be delivered to the locomotives. Outside the tunnel the current will be fed through a No. 0000 grooved trolley wire and pantagraph trolley to the locomotive equipment. The trolley wire will be hung by a catenary suspension from steel towers which span the track or from bracket arms mounted on lattice-work poles of steel.

The application of the single-phase system to the St. Clair problem was considered to provide an effective solution of the difficulties encountered. By its adoption, the company is enabled to eliminate chances of electrolytic troubles of every kind, and to secure an effective speed control with economical starting and rapid acceleration.

## Indiana Independent Telephone Meeting.

A special meeting of independent telephone representatives of companies constituting the fourth district of the Indiana Independent Telephone Association was held in Lafayette on January 5. About twenty-six companies were represented. The principal question for discussion was that of entering into a sub-licensee agreement with the Bell Company for long-distance business. The companies in the fourth district and a number of independent companies in Vermillion, Fountain and Parks Counties are said to be anxious to make long-distance contracts with the Bell Company at Danville, Ill. The representatives in attendance at the Lafayette meeting opposed this. The discussion resulted in the appointment of a committee to go to Danville and make arrangements with the city authorities and the Commercial Club to include independent long-distance lines in the matter of toll line business, as well as the Bell Company. The members present insisted that local independent companies must elect to remain independent or go entirely over to the Bell Company. No satisfactory division of the business can be made, they declared. Mr. William Vesey, of Indianapolis, gave a talk on the latest phases of the independent telephone situation in the State. He explained what the syndicate proposed to do in the matter of improvements and extensions and assured the representatives present that in a very short time all local independent companies in the State would have independent long-distance facilities at their command.

## Governor Higgins on Electrical Topics.

The subjoined passages from the annual mesage of Governor Higgins, of New York State, to the Legislature, deal with questions of interest in the electrical field, one being the "preservation" of Niagara, and the other the regulation of public utilities. In regard to the first named topic he said: "This State and the Dominion of Canada have in the past been engaged in an unworthy rivalry in granting franchises of incalculable value to power development companies, permitting them to take water from the Niagara River above the Falls for commercial purposes. The privileges granted to these companies now constitute a real menace to Niagara. The State of New York cannot carry on the work of preservation effectively without the aid of an international agreement to protect the cataract and the river from spoliation. It can, however, in some degree, repair the mischief already done (1) by limiting the amount of water which may be taken from the river by the New York companies now engaged in developing power, (2) by repealing all undeveloped charters, of which several remain on our statute books, dormant if not defunct, and (3) by instituting legal proceedings for the forfeiture of the charters of any companies which may be guilty of misuse of their franchises or abuse or usurpation of powers. I earnestly desire to impress upon the Legislature a due sense of the responsibility of this State for the protection and preservation of the grandeur and beauty of Niagara Falls."

Dealing with the subject of the regulation of public utilities, the Governor remarked: "Private companies control our railroads, telegraphs, telephones, gas and water supplies, and other services which have become necessary to the daily lives of many of our citizens. Such companies are quasi-governmental agencies, vested with the sovereign power to condemn private property for their uses. They are permitted to exist because the State delegates to them its own functions for convenience and economy, and to promote industrial development. Such corporations should be tolerated only so long as their rates are reasonable and their service prompt and efficient.

"It has been suggested by a learned Justice of the Supreme Court of the United States that such companies have not even the constitutional right to a profit on their investments, and that, while they cannot be required to do business at a loss, they may be compelled to content themselves with a return equal to the cost of operation and maintenance. So radical a theory has not been adopted, but that it should be declared from the bench of our most eminent and conservative tribunal is a significant sug-

gestion of the power of the people to regulate public service companies, or, failing therein, to exercise their functions directly through Government, State or local officials.

"In Great Britain the rate for gas in municipal plants averages 64 cents per 1,000, while in a number of the cities it is as low as 50 cents. In the United States the average charge is $1.25 per 1,000. It ill becomes the State to protect public service companies in extorting unjust charges from the consumer. Corporations are but associations of individuals. The act of incorporation does not make them outlaws nor deprive them of natural rights; nor, on the other hand, does it set them above the law. A careful investigation of the gas problem in New York City by a competent and conscientious legislative committee resulted in the recommendation of an eighty-cent rate to be established by law. A prima facie case was made out. The action of the Legislature was subject to judicial review. Yet relief was refused. I urge a further consideration of this question on your part."

## Power from Blast Furnace Gases.

In a paper read by Mr. H. Freyn before the Western Society of Engineers on December 20, much valuable information was given concerning the available power and cost of operation of a power station by waste gases from a blast furnace plant. The author deduced figures to show that a power plant having a capacity of 10,500 hp, complete in every detail and installed in connection with a blast furnace plant, would be capable, when running at full load capacity, of producing one hp-year at the low cost of $17.88, no value being placed on the blast furnace gas. It was shown that one kw-hour at full load capacity of the plant could be produced at .295 cents, which is considerably below the best results ever obtained with a steam engine power plant. When the power plant is running on an average of only 50 per cent of its total capacity, the cost of producing one kw-hour is only .55 cents.

In order to show that his deductions are of practical as well as theoretical value, the author relates the experiences of the John Cockerill Company, in Belgium, which has in operation at present seven blast furnaces of about 1,200 tons daily capacity, in addition to numerous other industries, necessitating the employment of 15,000 workmen. In 1900 the Cockerill Company had 86 electric motors in use, while in 1905 there were 333. The lighting equipment consisted in 1900 of 450 arc and 4,500 incandescent lamps, whereas in 1905 the corresponding figures are 660 arc and 5,600 incandescent lamps. In 1900 the power was produced by 1,000 kilowatts in steam engines; in 1905 only 800 kilowatts in steam engines have been in operation, 2,900 kilowatts of gas engines being used. The output in kw-hours produced per year increased from 1,789,281 in 1900 to 9,999,216 in 1905. The cost per kw-hour fell from 1.67 cents in 1900 to .412 cents in 1905. The author states that the reduction in the cost of power per kw-hour has been due almost exclusively to the installation of gas engines.

## The Municipal Plant at Holyoke, Mass.

Mr. W. H. Snow, the manager of the Holyoke, Mass., municipal lighting department, reports as follows, to the city authorities: The chief item of moment to be called to your attention is the increased and increasing volume of business transacted from the gas works and the electric station. From the former there has been sold 13,103,300 cu. ft. more gas than during 1904, an increase of 12 6/10 per cent; while from the latter there is being sent out about 40 per cent more current than at this time a year ago. During the year at the station there have been installed one 500-kw, turbo-generator with ample condensing apparatus, and three 300-hp boilers, practically doubling the steam capacity of the plant. The plant, at the rated capacity of the generators, is now equipped to furnish 2,200 hp in electric current, with water and steam power run together, but it can furnish only 1,733 hp in current with steam power alone. When the turbo-generator was purchased last winter it was thought that the equipment would be large enough to take care of the growth of the business for some years, but the station has already almost reached the limit of its capacity, it being able to take on only about 20 per cent more business with its combined water and steam power, and has reached the rated capacity of the steam plant. During the past fall the four remaining mill powers of the 16 appurtenant to the plant were taken, but the business has increased so much that some steam power has to be used every day in addition to the water power, as the water wheels do not furnish power enough for the daylight load alone.

All this leads up to the fact that the situation at the station is this: When the night and the day loads lap, as they do from sunset until 6:30 p. m., 80 per cent of the combined water and steam power is being used, and in case of the water being shut off by any cause, the whole of the rated steam power is being used. This means that within a comparatively short time the department will have to refuse to take on new business, through its inability to handle it, unless more generating apparatus is added to the station. In my opinion, the department should be given the necessary authority to add to the equipment at the station one 1,000-kw or 1,333-hp unit, including the steam power and electric generators. I would also respectfully suggest that action upon this extension be taken as early in the year as possible, as the electric machinery manufacturers are so crowded with orders, that to meet our needs the coming fall, it is necessary to order this machinery as early in the season as possible. Another matter of pressing importance to be considered in connection with the addition to the power at the station is coal storage. To be in a position to handle whatever demand for current that may come, a sufficient lot of land that is conveniently situated with regards railroad facilities and the station should be acquired to give storage ample for a winter's supply of coal.

## Power on the Stanislaus.

Further data come from San Francisco as to the financing in New York and Boston of a large hydro-electric enterprise to be developed by the Stanislaus Electric Power Company in the central portion of California, the power plant being located in Tuolumne County, on the Stanislaus River, at Subletts Crossing, about six miles from the town of Murphys, Calaveras County. Mr. Beach Thompson, of San Francisco, has been getting control during several years past of the water rights and other properties that will be acquired by the Stanislaus Electric Power Company, and has interested the Eastern capital that is now undertaking their development. These properties consist of a number of water rights on the Middle Fork of the Stanislaus River, complete rights of way for all the necessary canals, pipe lines, etc., several thousand acres of land for storage reservoirs, and several thousand acres of land to supply lumber for flumes and for other purposes.

The proposed construction includes storage reservoirs at the head waters of the river, a diverting dam near Sand Bar Flat, in Tuolumne County, a flume and ditch system 15½ miles long, with a capacity of 300 cu. ft. of water per second, a large equalizing reservoir above the power house site, a system of pipe lines which will deliver water to the power house under a head of 1,500 ft., a power station with water wheels and electrical apparatus having a capacity of 20,000 kw, and a very extensive transmission system which will make it possible to deliver power throughout the entire central portion of the State.

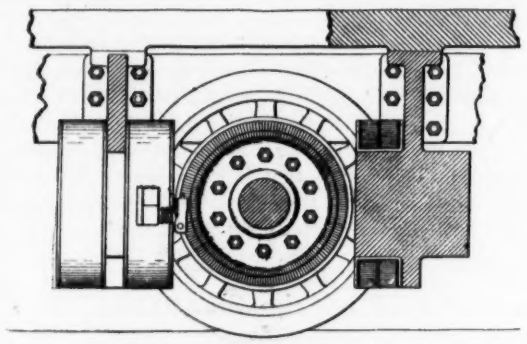
It is said the transmission system will be of a type of construction superior to any now installed on the Pacific Coast. High steel towers with cement foundations will be utilized on all the main lines instead of wooden poles, and a number of other usual provisions will also be made both in the hydraulic and electrical installations, to insure reliability and freedom from interruptions of service. Sanderson & Porter, of New York, are the engineers in charge of the construction work, which is to be undertaken by the Union Construction Company, a corporation formed for the purpose of building the system. The work of construction has already been commenced and will be pushed to completion as rapidly as possible.

Tucker, Anthony & Co., of Boston, who have financed and

managed a large number of electric railway and power enterprises in various parts of the country; Frederick Eldridge, first vice-president of the Knickerbocker Trust Company, of New York, and Cornelius C. Cuyler, of the banking house of Cuyler, Morgan & Co., New York, are the managers of the underwriters' syndicate, which has subscribed for the bonds. The Knickerbocker Trust Company, of New York, are the trustees for the bond issue, which is $10,000,000. Beach Thompson, Howard P. Veeder and James K. Moffitt, of San Francisco, and Harvey P. Goodman, of Napa, are among those largely interested in San Francisco. The bonds have been placed principally in New York and Boston. Beach Thompson and Howard P. Veeder are the California representatives of the Stanislaus Electric Power Company.

## Direct-Current Locomotive.

The accompanying illustration shows a method of constructing heavy electric locomotives as disclosed in a patent issued January 2, to Mr. A. S. Batchelder. The frame of the truck constitutes the field-magnet structure of the motors. The motor-armatures



DIRECT-CURRENT LOCOMOTIVE.

are mounted directly on the axles, and the frame of the truck is spring-supported from the axle-boxes. The pole-pieces are located in the plane of revolution of the motor-armatures and are cut away at the pole-tips so as to permit a free movement of the pole-pieces with reference to the motor-armatures as the axle-boxes play up and down in their bearings, and the axles are removable from their bearings in a downward direction and the pole-pieces are provided with substantially plane faces or at least are cut away sufficiently to permit the removal of the axles, with the wheels and armatures mounted thereon, by lowering the complete elements from the truck-frame without disturbing the field-windings or any other parts of the locomotive.

## Our Foreign Trade in Electrical Machinery.

By Henry L. Geissel.

The exports of the United States, which never touched the billion-dollar mark until 1895, and had not until 1905 in any calendar year, been as much as a billion and a half dollars in value, exceeded that figure last year considerably, and approximated 1,600 million dollars. The total figures for the month of December are not yet at hand, and therefore the amounts given in the following account may be subject to slight corrections upon the final balancing of the statistical returns for the past year.

The expansion in our foreign commerce makes itself apparent in our trade relations with nearly all of the principal countries of the world, and the most gratifying feature of our export trade is the considerable increase in our exportation of manufactured goods. These exports exceeded those of 1904 by about 55 million dollars. As close as it can be figured, manufactures form over 38 per cent of the total exports of domestic products. The total exports of electrical machinery last year exceeded $7,000,000, an increase of nearly one million dollars over the preceding year. This does not include electrical instruments of any kind, worth several millions.

In any city in any part of the world where the progressive steps of civilization demand the institution of economies and labor-saving devices, it is only a matter of time to find a means of obtaining money for their first cost. Telephones, electric lamps and railways are now being introduced into the remotest parts of the world. The demand for electricity is increasing the world over. The writer visited last year several countries on the northern coast of Africa and sixteen of the leading countries in Europe. He had made the same tour three years ago and was surprised to see the progress which had been made in the many different lines of electricity. Even in the south of Europe, in countries which are lamentably slow in the adoption of modern ideas, the electric current has made a wonderful showing of late.

In the town of Lund it is now proposed to utilize some of the waterfalls on the Laga River, not only for lighting Lund itself, but also for several other towns in the south of Sweden. During the negotiations made with the owners of these falls it was stated that a syndicate in Denmark would also make offers for the falls with a view to using them as a source of electric energy. The Laga River comes from the Smaaland uplands, runs for three miles through the Province of Halland, and has two large falls, the "Majefos" and "Catefos." This latter is about one mile from the river mouth and here the Danish Syndicate proposes to erect power stations, the electricity being transmitted by cable to the coast of Helsingborg, and thence, by means of submarine cables, to Denmark.

Several strong companies and syndicates are now being organized in Stockholm; they are backed by Scandinavian and German capital, and their object is to harness all the streams of Sweden with a fall of water sufficient to generate electricity.

Our two best customers of electrical machinery last year were Canada and Japan, the former having bought nearly two million dollars worth—or about 35 per cent of our total exports—and Japan over one million dollars. The third place is occupied by Mexico, to which country we shipped electrical machinery to the value of one million dollars.

In Europe, the United Kingdom leads the list with over $800,000. Then follow France, Germany, Italy, Holland, Russia, Scandinavia and Spain. Our total shipments of electrical machinery to Europe average in value $1,500,000, those to Central and South America, $500,000; to Asia, $1,400,000; to Africa, $150,000, and to Australia, $250,000.

Of the South American countries, Brazil and Argentina are our best customers. To the former we exported electrical machinery to the value of about $210,000, and to the latter $165,000. Smaller quantities went to Chile, Peru, Uruguay, Colombia, Venezuela, Ecuador and Bolivia. The total exports to Central America were valued at only $13,000, and those to the West Indies $88,000, of which nearly $85,000 worth was exported to Cuba. It is very much to be regretted that our trade with South America is so insignificant. Germany and the United Kingdom practically control the trade in electrical machinery in those countries.

But South America is not a negligible quantity by any means. It is, indeed, astonishing to see how the nations of Europe have outdistanced us of the United States right on our own western hemisphere. The large German electrical manufacturing companies have had for years their branches in almost every republic to the south of us. It was only recently that the Peruvian Government decided to install a great system of wireless telegraphy throughout the country, and the contract went to Berlin, the German house securing therewith the exclusive right of establishing wireless telegraphy within the boundaries of Peru.

Great strides ahead are also being made in the electrical industries of Brazil. The Rio de Janeiro Tramway, Lighting & Power Company, capitalized at $25,000,000, proposes the development of water power and the utilization of it in the form of electric energy in Rio de Janeiro and other cities. According to a recent report, the company has already acquired two large waterfalls, one on the Parahyba River, a distance of about 80 miles from Rio de Janeiro, capable of producing about 100,000 hp; others on the Rio das Legas and streams in the vicinity about 50 miles from Rio de Janeiro, capable of producing 40,000 hp. The latter plant the company is now developing and expects to have power from it in Rio de Janeiro within six

months. It is estimated by the company that there is a present demand for 25,000 hp. This, it is expected, will be considerably increased as the advantages of the use of electric power become fully demonstrated. The same company has acquired a number of suburban street car lines now operating with animal traction, the electrification of which will soon begin.

The greater part of the electric plant equipments and practically all the electric traction machinery used in Argentina are from the United States. Small electric motors and their fittings are also chiefly American, but the bulk of the electrical trade is still in the hands of European concerns. It is estimated that the total imports of electric materials in 1905 amounted to over $3,000,000, of which over $1,000,000 worth came from Germany. The same proportions prevail in Chile and other South American countries.

It was stated previously that Japan is one of our largest customers of electrical machinery. Of our total exports to Asia of about $1,400,000, Japan received nearly $1,100,000, or nearly 80 per cent. The Japanese electrical industry centers around the city of Osaka, the seat of the great manufacturing industries of the Empire. The Japanese Government has appropriated large amounts for enlarging and repairing arsenals, shipbuilding yards, harbors, Government railway shops and general engineering works operated by the Government, and the demand for modern electrical machinery will, in all probability, continue to increase during the present year. Electricity has also been introduced to a large extent in the Japanese mining industries: the Hokkaido Collieries, the famous Ashio copper mines and a number of other mining enterprises are equipped with large and up-to-date electric plants, the machinery being chiefly of American origin. In connection herewith it may be said that there is quite a brisk demand for electric motors to drive machinery in factories. The use of electric lighting is also spreading. In all probability the equipments of electric traction will be of considerable importance in the exports of American manufacturers to the Japanese market.

In China there is as yet little demand for electrical machinery, with the possible exception of telegraph equipments. Electric launches for use in navigating rivers and harbors might perhaps find a slight sale if properly pushed. Electric lighting plants are in use to some extent in the treaty ports. The use of electric power and traction machinery is confined to foreign establishments. The telegraphs and telephones, though sharing in the prejudice of the Chinese against all foreign innovations, have been adopted to a considerable extent. Not only foreign firms, but many Chinese merchants also, have their telephones, and several thousands of miles of telegraph lines have been built and others are projected.

The popularity of American electrical appliances and machinery in India, notwithstanding the protests made against their introduction by the British press appears to be growing. It seems, however, that no serious efforts have been made on the part of American manufacturers to secure a firmer foothold in the Indian market. The same is the case in the Dutch East Indies, where German firms are doing considerable trade in electrical machinery and appliances.

More attention should also be paid to the South African markets. The city of Johannesburg is planning to spend millions of dollars for improvements. An immense generating plant is now being installed there which will have one of the most extensive networks of conductors, the contract for which was awarded recently to a British firm. Some idea of the magnitude of this contract will be gathered from the fact that about 3,000 tons of cable and material will have been shipped from England before the completion of the undertaking is within sight. The present contract will amount to about $600,000, and it will include the furnishing of some 270 miles of cables for electric undertakings.

In conclusion it may be said that the problem of supplying electric power for industrial purposes is daily receiving more serious attention in most parts of the world. The demand for modern electrical machines and appliances is steadily increasing, and American manufacturers should spare no time or effort to secure a firmer and permanent footing in the various markets of the world.

## Electrical Engineers of the Times.—XLIV.

DR. N. MONROE HOPKINS.

Nevil Monroe Hopkins was born September 15, 1873, in Portland, Maine. He received his early education in private schools in Washington, D. C., in Dresden, Germany and in Paris, France. Upon his return from abroad he entered the Corcoran Scientific School of the Columbia University at Washington, D. C., and specialized in electricity in a four-year course, taking the degree of Bachelor of Science.

After graduation in 1895 Mr. Hopkins engaged in the practice of applied electricity and electrical engineering, commencing by wiring for lamps, generators and motors, and line construction work. In 1896 he started a research and testing laboratory and equipped it for electrical measurements, calibrations and general electrical testing work where laboratory methods are basic. Subsequently he was appointed in the Expert Department of the General Electric Company at its principal Schenectady works and was engaged in assembling and testing generators and motors, conducting laboratory and efficiency tests. During the Spanish-American War he was engaged in experimental torpedo work.

Dr. Hopkins, in connection with his private practice, has made extensive investigations on the economy and performances of electric power plants. He is the inventor of a system for pre-

DR. N. MONROE HOPKINS.

venting the bursting of water pipes and mains by freezing and has carried on experimental work in thawing out pipes and other conduits through the application of electricity. He was granted a series of United States and foreign patents and was awarded the "John Scott Medal" by the City of Philadelphia, on the recommendation of the Franklin Institute of the State of Pennsylvania, in recognition of the merits of his invention, and was retained for a year by the company purchasing these patents as designing and consulting engineer, during which time the system was installed in many factories and plants throughout the country, as well as in many Government buildings and reservations.

In the fall of 1898 Dr. Hopkins arranged to carry on further work in the Columbian University and in 1899 was appointed assistant in the Laboratories, pursuing a post-graduate course also, during instruction duties, and was granted the degree of Master of Science. In 1901 he was appointed instructor, and lectured upon applied electricity, electrochemistry, and electrochemical engineering. Upon receiving the degree of Master of Science he undertook further post-graduate work at Columbian and Harvard Universities in applied electricity, advanced physics and electrochemistry and was granted the degree of Doctor of Philosophy.

Dr. Hopkins has acted in an expert capacity for the Smithsonian Institution, the Germania Electric Company, and many other private corporations, when he was a partner of the expert firm of Monroe, Hall & Hopkins, chemists, assayers and engineers, of which Professor Charles E. Monroe, the well known expert in chemical matters, and formerly professor in the United States Naval service, is senior partner. During Dr. Hopkins'

connection with this firm a most varied chemical and electrical practice was enjoyed. During the summer of 1904 he traveled abroad, making a study of German, French and English electrical installations. His extensive knowledge of chemistry and electricity secured for him in the fall of 1904 an appointment of assistant professor in the George Washington University, where he was placed in charge of the courses of electrochemistry, electrochemical engineering and advanced research work in the application of electricity to chemical purposes. Recently he received the appointment of chief electrical engineer, Bureau of Yards and Docks, U. S. Navy, in charge of electrical and mechanical work in connection with consolidation of power plants at various navy yards.

Dr. Hopkins is the author of several technical text-books and has in preparation at the present time a treatise on "Alternating-Current Phenomena." He is a member of the American Institute of Electrical Engineers, the American Electrochemical Society, and after election as a member of the American Association for the Advancement of Sciences, was subsequently chosen a Fellow of the association. He has written over two hundred technical articles for the various engineering and electrical journals. His recent appointment by the secretary of the navy to the position, placing him in charge of the consolidation of navy yard power plants, is of general interest, since it is the first appointment as electrical engineer in this service.

## CURRENT NEWS AND NOTES.

*CIVIL SERVICE EXAMINATION.*—The United States Civil Service Commission will hold examinations at Washington, D. C., on January 24 for the position of electrical engineer and instructor at the Washington Barracks, D. C.

*TELEPHONING PRESS NEWS.*—The Associated Press news in a large section of Michigan, including most of the State, is now being handled over the service of the Michigan State Telephone Company, with telegraphy and telephony over the same wires.

*SPANISH CABLE.*—A Madrid despatch of January 5 states that the government is inviting tenders for a new cable from Cadiz to Teneriffe. The competition is open to the world. The firm offering the best guarantees will be chosen. The conditions have not been settled finally.

*NEW STYLE TROLLEY BRIDGE.*—A "trolley" bridge, estimated to cost $175,000, is to be built by New York City over Dutch Kills Creek, in Long Island City. The bridge will be a new type. It will not lift or turn, but will roll off on car trucks to one side, the power used being electricity. The bridge will cross the creek at Borden Avenue.

*A. I. E. E. PITTSFIELD BRANCH.*—At the meeting on January 5 at Pittsfield, Mass., of the local branch of the American Institute of Electrical Engineers, Mr. Samuel G. Colt read a paper on "Lubrication," and Mr. Gilbert Wright presented abstracts from Mr. H. W. Buck's paper on "The Duplication of Electrical Apparatus to secure Reliability of Service."

*ILLUMINATING ENGINEERING.*—The growing recognition of the value of illuminating engineering as an art is indicated by the recent establishment by the General Electric Company of a department of illuminating engineering in charge of a specialist. It is announced that among other purposes will be coöperation with central station managers in submitting attractive lighting plans to prospective customers.

*A MUNICIPAL CONGRESS.*—Sir Edwin Cornwall, chairman of the London County Council, has issued to the press a proposal for an international congress of representatives of capitals having over 500,000 population, to meet annually for the discussion of municipal methods. In conjunction with this congress Sir Edwin proposes an exchange of pupils between the schools controlled by the municipalities holding membership in the congress.

*PROF. BELL'S GIFT TO VOLTA BUREAU.*—A Washington dispatch of January 5 states that a gift of real estate and bonds aggregating $75,000 to the Volta Bureau was on January 5 announced by Dr. Alex. Graham Bell as a memorial to his father, Prof. Alex. Melville Bell. The bureau was established by Dr. Bell with the object of increasing the diffusion of knowledge relating to the deaf and dumb, and with the endowment the scope of its work can be greatly extended.

*CIGAR LIGHTERS.*—To show where the electric cigar lighter comes in, we quote the following passage from a letter received recently from Pittsburg as to an accident at the Fort Pitt Hotel: "The cigar lighter in question was a small affair, of a very neat and handsome design and contained alcohol. A small wicking was used and there was a light at the top on the order of a torch; then, in the side of the little lighter was a small wire which was dipped in alcohol, and then you made use of this little handle in lighting the cigars. I thought so much of the pattern that I decided to order a few for Christmas, but upon going down to the hotel to find out who made the lamps, I was told those in use at the Fort Pitt had been discarded entirely, as one or two of them had exploded and one of the waiters was quite seriously hurt, and for this reason I decided not to use any of these lighters at all. I might furthermore say that the lighters in question were used directly on the table and after the dinner might be over. I believe that something of this kind made to use with electricity would be a very taking article." Such electrical devices exist and are very handy.

*TWO AUTOMOBILE SHOWS* will open in New York City this week on January 13, one in Madison Square Garden, under the management of the Association of Licensed Automobile Manufacturers (licensees under the Selden patent), and the other under the auspices of the Automobile Club of America in the magnificent new armory of the Sixty-ninth Regiment. In spite of this rather unusual rivalry both shows promise to be great successes, and great preparations have been made. The Armory exhibit will include aeroplanes. While the automobile in all its advancement will be contained somewhere in the mammoth structure, space has been found in the gymnasium for the Aero Club of America which will prove a surprise. It is probable that the "Aero Club No. 1," the dirigible balloon which Leo Stevens, the famous aeronaut, designed, will be suspended from the top of the curved roof in the big drill hall. What should prove another attractive object in the airship department will be Prof. Alexander Graham Bell's kite, which, though of enormous size, is by its peculiar tetrahedral principle of construction, literally as light as a feather and is still so strong and substantial that it has recently supported in flight for a long time, a man weighing 165 pounds and tackle weighing 62 pounds.

*NORTHWESTERN ASSOCIATION.*—Mr. T. R. Mercein, secretary, advises us that as already noted, the fourteenth annual convention of the Northwestern Electrical Association will be held at the Great Northern Hotel, Chicago, commencing at 9:30 on Wednesday morning, January 17. An electrical show, the finest ever held in the West, will be in progress at the Coliseum at that time. The management of the Show has set aside Thursday, the 18th, as "Northwestern Electrical Association Day." An unusually fine programme has been arranged, and an interesting and instructive time is assured to all who attend this meeting. The Western and Central Passenger Associations have granted a one and one-third round trip rate from all points in their respective territories. The hotel has made special rates for the occasion from $1.50 per day upward. During the week the American Electrical Salesmen's Association will hold its first regular meeting at the Grand Pacific Hotel, Chicago, when an interesting programme will be taken up. The meeting will be opened by President Vinton Gray, on January 20, at 9 a. m. Mr. E. E. Rines will present a report, Mr. J. Robert Crouse, Jr., will deliver an address, and some important topics will be discussed.

*CLEVELAND TRACTIONS.*—The ever restless Mayor Johnson, of Cleveland, is now in favor of the formation of a holding company to take over all the traction properties in the city, to be operated by the company in behalf of the city.

*DISINTEGRATION OF GOLD.*—Prof. F. Soddy, of Glasgow University, whose radium investigations have attracted so much attention, holds the theory that gold is gradually disintegrating into other materials. As a matter of fact we have ourselves already had practical experience of this alarming phenomenon.

*NEW YORK SUBWAYS.*—The transit committee of the New York Board of Trade and Transportation has issued a call for a public meeting to be held at the organization's rooms, 203 Broadway, January 25, to consider the question of future subways and their control. The Board believes it essential that effective city control over future lines should be reserved, and through its transit committee it has submitted to Mayor McClellan, the rapid transit commission and the board of estimate and apportionment a memorial, in which is set forth its views. The purpose of the meeting to be held is to ascertain if possible the best method of securing this control.

*THE YERKES HOSPITAL.*—It is stated that the widow of Mr. C. T. Yerkes will at once take legal steps necessary to enable her to see the erection of the Yerkes Hospital willed by him to the borough of the Bronx, New York City, during her own life, instead of allowing it to be built after her death, as is provided by her husband's testament. Should the courts grant the desired permission, she will make the building and maintenance of the hospital her life's work. Under the directions of Mr. Yerkes' will $800,000 is to be expended for the ground and the buildings of the hospital which is to be erected in the Bronx. For its maintenance the income from one-half of the estate, which was left to the widow during her life, is to be employed. It has been estimated that this will amount to a sum in the neighborhood of $15,000,000. As the will is to be probated in Illinois, it will be necessary to obtain the consent of the courts of that State for the change.

*LIFE AND CURRENT.*—A special dispatch from Berkeley, Cal., of January 8, says: "Dr. Jacques Loeb, who is engaged in extensive experimentation concerning the phenomena of the generation of animal life, announces that he has discovered the reason for the electrotonic effects of the galvanic current upon nerve and muscle tissue. It is due, he says, to physical causes in the tissue itself. In previous investigations Dr. Loeb had discovered that sodium and potassium in solution stimulated nerve and muscle fibres, and that the subsequent administration of solutions of calcium and magnesium neutralized the stimulating action of the other two substances. Dr. Loeb now says that his last set of experiments has demonstrated that this phenomenon is due to the fact that when the galvanic current is applied these chemical substances migrate and concentrate in the region of application of the electrodes, or poles of the battery. The oleates and stearates, which are normally in the nerve and muscle tissue, precipitate the calcium from the solution under the action of electricity, and in this way the calcium, or lime, is prevented from interfering with the stimulant action of the sodium and potassium."

*STREET SIGNS.*—New York, like other large cities, is badly in need of signs for designating streets, as legible by night as by day. Last week, there was a meeting at the Bar Association of representatives of various associations and business clubs to see what could be done in the way of placing signs that could be read at the street corners and numbering houses so that the numerals could be seen from the sidewalks in the day time or with the ordinary street lamps at night. J. L. Brower, president of the Street Sign Conference of Municipal Organizations, presided. He recalled the past work of the organization that seeks to make it possible for the stranger to find his way about in New York and New Yorkers in unaccustomed localities, which resulted in the appropriation of $30,000 for the placing of legible street signs. He said that Borough President Ahearn had been very courteous, and had promised to soon have the signs completed and installed. He then read a list of some five typewritten pages giving important points of the city which had no designations in the way of signs. Among them were the entrances to Central Park, the Grand Central Station, and Union Square. A resolution was adopted that the chair appoint a committee of seven to ask the Borough President whether the appropriation of $30,000 was used up, and if so to see to it that there should be a further appropriation. Nearly 7,600 signs are still needed, and about 1,400 have been placed. It was also resolved that an ordinance should be drawn making it mandatory that every residence and place of business in New York should have numbers that could be distinguished at night as well as in day time. Some very interesting and effective types of electrical street lamp signs have been placed on the thoroughfares of Manhattan.

*LONDON UNDERGROUND.*—At a meeting of the board of the Underground Electric Railways Company in London, on January 3, Mr. Edgar Speyer was elected chairman of the company in succession to the late Charles T. Yerkes. Sir George Gibb, general manager of the Northwestern Railroad, was elected deputy chairman and managing director of the Underground Company and also chairman and managing director of the Metropolitan District Railway Company, vacated by the death of Mr. Yerkes. The board passed a resolution recording its deep regret at the death of Mr. Yerkes. It is stated that Mr. Edgar Speyer will have charge of the general financial interests of the company and Sir George Gibb will have the executive direction of its technical operation. Sir George Stegman Gibb, LL.B., is 55 years old and an Aberdeen Scotchman. He is accounted one of the most successful and up-to-date railroad officers in England. His railroad experience began in the legal department of the Great Western Railway Company in 1877. He was later solicitor and then general manager of the North Eastern Railway Company, which office he now leaves to enter the service of the London Underground. He has held various political appointments of importance and was knighted in 1904. He is a man of wide attainments and has been noted in England for his progressive policies in railroad affairs. As manager of the North Eastern Railway he introduced the American system of ton and passenger mile statistics, and during five years effected an increase of 52 per cent in the freight train loads of his road. The autocar system for branch line passenger traffic, now being taken up in this country, was another of his innovations in England. He visited America this year for the International Railway Congress.

*ELECTRICITY IN SWEDEN.*—U. S. Consul Bergh, at Gothenburg, notes the plans already discussed in these columns to equip the government railroads electrically, and adds: The Helsingborg-Raa-Ramlösa (5 miles) is now being changed to electric power. A power station is under construction in Helsingborg. The power is obtained from three suction gas engines, with peat as fuel. The power station is built by a Swedish firm which has the patent rights on the engines, which are said to be very economical. The owners of the Gothenburg-Särö Railroad (14 miles) have received plans for the adoption of electric power for that road. The intention is to take current from Yngeredsforsen, near the city of Falkenberg, with a transforming station about 6 miles from Gothenburg. Three or four new short electric railroad lines near Gothenburg are also planned. It is reported that the cities of Skara and Lidköping and certain companies are negotiating for electric power from Vargöns Aktiebolag at Trollhättan. The plant will initially have a capacity of 1,500 hp. The board of finances for the city of Lund has recommended the building of an electric power station in that city, and the committee on electricity has recommended that the city should build electric street railways to take the necessary power from the power station. Since the property of the Trollhättan Canal Company was purchased by the government the new board of managers was instructed to investigate plans for a large electric power plant at Trollhättan. Three engineers are working on plans which are not expected to be finished and submitted to the Riksdag before 1907. It is calculated that it will require three or four years to build the power station, and that the cost will not exceed $38 per effective horse-power. As the water power at Trollhättan is large it is considered that many Swedish industries will derive great benefit from the plant.

*POSTPONEMENT OF MARCONI LECTURE.*—Cable advices from England report Mr. Marconi as seriously ill with influenza and under imperative orders from his doctors not to undertake a sea voyage for some time to come. Mr. Marconi's lecture before the New York Electrical Society, which was arranged for January 16, has accordingly been postponed. Mr. Marconi, however, will be here in March and has pledged himself to give the society this lecture in the third or fourth week of that month.

*TELEPHONE SITUATION AT EVANSVILLE., IND.*—After years of litigation the United States Court of Appeals has affirmed the decisions of the U. S. District Court of Indiana in the case of the Cumberland Telephone Company against the city of Evansville, holding that the Cumberland Company is in the streets of Evansville as an absolute trespasser and without any rights under the law. The injunction to prevent the city from disturbing the company's property and ousting it from the streets, has been dissolved.

*A JUICY FALSEHOOD.*—In *Everybody's Magazine*, a writer named Russell is publishing some wildly incorrect articles in favor of municipal ownership. This is the way, moreover, that the publication is advertising them: "In Boston, unlimited telephones are $162 a year. In Glasgow, $26.25—the city owns the telephones; and makes $108,000 a year for the public purse. We have much to learn from the old world and Russell is teaching it in his interesting and wonderful fact-stories in Everybody's. See January." See it by all means as a sample of very "light" literature.

*WESTERN SOCIETY OF ENGINEERS.*—The Western Society of Engineers elected officers and held its annual banquet at Chicago, January 2. Electrical interests are unusually well represented among the new officers. The presidency went to Mr. Bion J. Arnold. The first vice-president is Mr. W. L. Abbott, chief operating engineer of the Chicago Edison Company. The second vice-president is Mr. Andrews Allen, and the third vice-president is Prof. Dougald C. Jackson. The other officers elected were: Treasurer, Mr. A. Reichman, and Mr. F. H. Bainbridge, trustee for three years.

*EFFECT OF TROLLEYS.*—The effect of trolleys is clearly brought out in the statistics of steam railroad construction. It is stated that 4,979 miles were added last year, an increase of 727 miles over 1904. It was generally expected that more new mileage would be built in 1905 than during 1904, when construction work was suspended owing to unfavorable money conditions. The figures do not compare with the period of competitive railway building in the early 80s, or even with construction work considered normal only a few years ago. In spite of all the prosperity of the year 1905, its new railway construction has been the smallest but one of any calendar year since 1900. This may not all be the effect of the trolley, but it certainly had a great deal to do with it.

*A. I. E. E. BUILDING FUND.*—The General Electric Company in view of the great importance and utility of the United Engineering Building, as a home and center for the engineering professions and arts, has made a contribution of $25,000 to the land and building fund of the American Institute of Electrical Engineers. President C. A. Coffin, who takes a warm personal interest in the matter, has also sent his own check for $5,000. The committee, which had already received gifts and pledges amounting to nearly $70,000, is greatly encouraged by this generous support of its work. The fund is now with other new subscriptions well over $100,000, and with renewed energy the committee has begun its canvass of the field with the object of securing the second necessary $100,000. About 600 members have already subscribed to the fund, and the committee expects to have no difficulty in at least doubling this number. It has just issued to the whole membership a handsome pamphlet, illustrating and describing the new building in course of erection in New York City, and detailing the steps that have been taken by the associated engineering bodies to give effect to Mr. Carnegie's original gift.

*FATAL IMPATIENCE.*—At Hoxie, Ark., on December 29, because he did not receive a reply to a telegram as quickly as he wished, Frank Browning, of Batesville, shot and killed T. W. Midkiff, a telegraph operator here. Browning despatched a message to Dexter, Ark., and on being told he might expect a reply by 4 o'clock, returned at 1.50 and demanded the answer. On being informed that it had not been received, he drew his revolver and shot Midkiff through the head. He was arrested and taken from this city to prevent a mob from lynching him. A less tragic case occurred recently in a New York hotel, where a domestic became so violent in her abuse of the telephone operators, and the hotel manager because the telephone answer was slow in arriving, that she was put under arrest.

*TRIAL BY TELEPHONE.*—Last week at Kingston, N. Y., Judge Betts sitting in chambers, conducted court in Albany by telephone, in a case of negligence and damages. After the hearing of the case in Albany the jury retired and Judge Betts left for Kingston after securing the consent of Judge Fitts to receive the verdict. The jury was out all night and entered the court-room next morning and asked for further instruction. Judge Fitts was not familiar with the case and Judge Betts was called up at Kingston. Over the telephone he made clear the point in the evidence which the jury wanted explained. The attorneys on both sides argued over the telephone with Judge Betts. The jury reported later that it was unable to agree and it was discharged by Judge Fitts. Legal proceedings of this nature are believed to be unique.

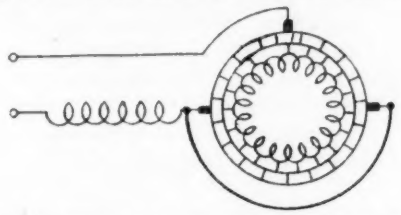
*PUBLIC UTILITIES BOARD.*—At Albany, on January 2, in the State Legislature, and, it is said, embodying the views of Tammany Hall, Senator Grady introduced in the Senate a bill for creation of a Board of Public Utilities in the City of New York. The bill was introduced, he explained, with the idea of redeeming pledges which the Democratic organization made to the people at the last city election. The body practically would absorb the powers of the Rapid Transit Commission. The Grady bill proposes a board of five members appointed by the Mayor—a civil engineer of not less than ten years' experience, one member who has at least ten years' experience in practical operation of street, elevated, or subway railways in the city; one wage earner of ten years' experience in some mechanical occupation, one lawyer of ten years' experience, and one business man of ten years' experience. The salary is to be $7,500 a year each. The board is to regulate car and ferry services, to require and compel efficient telephone service at reasonable rates, and an honest, efficient and adequate service of all other public utilities. It is to devise, lay out, and, with the approval of the Board of Estimate, contract for such new public utilities as may be determined by the board to be for the interest of the city, or acquire existing utilities, and to act as arbitrator, when requested, of any dispute between owners or operators of any public utility and employes.

*NEW ENGLAND TROLLEYS* had a good year, but were not all of them profitable, the rural lines in some instances failing to pay dividends or operating at a loss. The dividend returns from all the street railway companies in the State, for the year which ended September 30, 1905, show a decidedly better year than the previous one, but still go to prove in spite of the general prosperity of the country, that the development of the electric railway service is much in advance of the needs of the territory served. There are 101 companies which made returns, only 38 of these declared dividends, while 35 reported a deficit. There were 48 in all which carried something to their surplus account; 24 which paid dividends and had a surplus; 10 which paid dividends and had no surplus; 2 where the dividend declared was more than the net divisible income reported for the year, and therefore they had to draw on a surplus previously accumulated, and 6 where the dividend declared was exactly the same as the net divisible income reported. The total of dividends declared by all the street railway corporations for the year was $3,174,505. As the total capital stock of all the companies is $70,326,984, and their funded debt is $55,780,500, or a total of stock and bonds of $126,107,484, it appears, not counting the floating debt, that the rate of dividend upon the investment was considerably less than 3 per cent.

*N. E. L. A.*—Secretary Eglin has just issued the new membership list of the association brought up to date. A cursory glance shows considerable growth during 1905, and the fact is mentioned that already this year two new applications came in during the first week. The list is in neat pamphlet form.

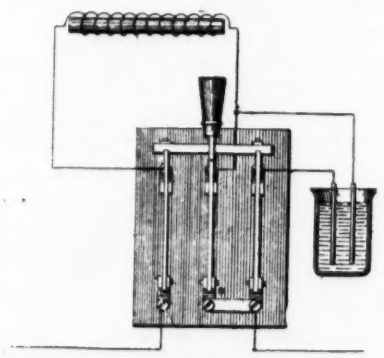
*MUNICIPAL FERRIES.*—The New York-Staten Island ferry service broke down again last week, on January 3. Meantime the system is running behind $536 per day, or $195,640 per annum, charging off nothing for depreciation. The annual loss to the city is estimated at $300,000. The operating expenses are 40 per cent higher than under private ownership.

*COMPENSATED SINGLE-PHASE MOTOR.*—In order to avoid the great number of brushes and the great higher harmonics of the compensated type of repulsion series motor, Messrs. E. Arnold and J. L. La Cour, according to a patent issued December 26, 1905, would make use of three brushes set at angles of 120 electrical degrees to one another as shown in the illustration here-



with. Two of the brushes are short-circuited and are so arranged that when the rotor is stationary the total stator field is destroyed. The current enters the rotor through the third brush and leaves by way of the two short-circuited brushes. The current which passes through the third brush causes a magnetic field perpendicular to the field which the stator current tends to produce, and it is this field which gives torque to the rotor due to the current which flows locally by way of the short-circuited brushes.

*ELECTROLYTIC SWITCH.*—Two patents were issued December 26 to Mr. W. S. Horry and deal with the use of an electrolytic cell in parallel with a switch in order to prevent the formation of an arc when the switch is opened. The anode of the cell, which consists of aluminum or an aluminum alloy, has the well-known property of offering an abnormally high resistance to the flow of current therefrom to the electrolyte, this resistance being sufficient to substantially prevent the flow of current under an applied electromotive force of one hundred and ten volts. The high electromotive force resulting from the action of the inductance temporarily breaks down the resisting property of the



aluminum, and the current is thereby shunted around the switch-break and through the cell. The potential difference at the terminals of the cell immediately falls to normal, and the anode resumes the condition in which it tends to obstruct and prevent further flow of current. The accompanying illustration shows a special switch which has been constructed to successively open the main and the protective shunt circuits. The switch comprises three movable blades, two of which control gaps in the main circuit, while the third controls a gap in the shunt circuit. One of the main circuit blades and the shunt-circuit blade are arranged to move in unison, while the second main circuit blade is arranged to both open and close its gap before either of the other blades is operated.

*THEATRE TELEPHONES.*—New York suburban theatre-goers will benefit by a new arrangement between Charles Frohman and the New York Telephone Company, which was completed last week. Frohman theatre telephone stations will be opened in a large number of suburban communities, connecting directly with the Empire, Criterion and Herald Square Theatres. Each station will have an operator provided with seating plans, who will keep informed of the location of unsold seats. Patrons may order seats at the local station, pay the operator and get a receipt, entitling them to have the tickets mailed to their homes or held at the theatre. The plan has been put in operation with the new year at New Rochelle, Mount Vernon and Newark, and if successful will be extended to Brooklyn, Flushing, White Plains, Yonkers, Staten Island, Montclair, Morristown, the Oranges, Elizabeth, Plainfield, Westfield, Summerville and Jersey City.

*LIGHTING AT PROVIDENCE.*—The city lighting contract at Providence, R. I., referred to in an item in our last issue, was adopted by the Board of Aldermen, and on December 22 was executed between the Mayor of the city, and Mr. Marsden J. Perry, on behalf of the Narragansett Electric Lighting Company. As noted, it runs to 1912 and when completed will represent 29 consecutive years of city lighting done by the Narragansett Company. The first contract for lighting the streets of Providence by electricity was placed with the Rhode Island Electric Company, using the old United States system. It was for ten lights at $1 per light per night. The Narragansett Company came into active business life early in 1883, and for that year the contract for city lighting was awarded to it for $200.75 per lamp per year. The city now uses about 2,100 arc lamps and about the same number of 32-cp incandescent lamps for its streets, supplemented by 600 Welsbach gas lights. The new contract begins on a sliding scale at 28.7 cents per night, all night. This is for the first three years. The rate for the next three is 27.4 cents. Midnight arcs will be 55 per cent of these prices. All night incandescents will be $24 per year.

*FRANKLIN'S VERSATILITY.*—In the *Forum* for January-March, anent the Franklin celebration this month, Prof. W. P. Trent says: "Everywhere we touch him he is the human and therefore the fascinating Franklin. This statement is, to be sure, an exaggeration—one of the sort at which he would have smiled with deprecating modesty or else, with a malicious twinkle of the eye, would have told an unsavory anecdote with disenchanting results. There were sides of Franklin's character—well remembered, it would seem, in Philadelphia—that were not at all attractive. Prof. Smyth calls attention in a paragraph to the 'smudgy trail' the facetious printer left behind in the *Pennsylvania Gazette*, to the grossness of some of his letters, to the effect of his strong animal instincts upon his conduct. It is this, combined with his comparative insensibility to poetry and to spiritual religion—which Prof. Smyth does not emphasize—that puts Franklin, in the final analysis, below such men as Johnson and Washington, to whom he was vastly superior in many intellectual respects and who may themselves be justly taxed with æsthetic deficiencies. But when his limitations have been duly considered, it remains true that Franklin, like Defoe, and for much the same reasons, is one of the most fascinating of mortals, at least to students who examine minutely every phase of his character by means of his self-revealing writings. Both men had in its fullest development what may be called the genius for the prose of life. In both this genius is fused with a sort of plebeian spirit, with the result that they do not greatly appeal to over-sensitive souls. Other souls less squeamish, more robust, more catholic, if you will, take a special delight in watching the effects of this combination of democratic and aristocratic elements upon the lives and writings of these two great sons of the people, whose masterpieces will not cease to be read until the precious style affected by numerous moderns becomes an eternal possession of the English-speaking masses. When that delectable day comes, 'Robinson Crusoe' and Franklin's 'Autobiography' may be banished from whatever substitute the æsthetic world shall have devised for homely book-shelves. Pending this consummation, it is to be hoped that Franklin's writings will remain in broad circulation."

# The Electrical Distribution System of the Public Service Corporation of New Jersey—I.

By G. U. G. Holman.

As a striking example of the tendency of public utility enterprises to get together for the benefit of single management, and what might be termed as single engineering, that of the Public Service Corporation of New Jersey is the most prominent in the Eastern section of America.

On the continent many central electricity supply stations have been succeeded by one large plant and it is more and more being deemed profitable to unify the scattered systems in this country.

The benefits to the public have been many, resulting in lower rates for light and power, better facilities and longer traction rides for the same amount of money, and a far more dependable service.

### HISTORICAL.

The Public Service Corporation of New Jersey was organized under the laws of the State of New Jersey in June, 1903, for the purpose of controlling the following corporations by purchase of the majority of their stock:

North Jersey Street Railway Company, Jersey City, Hoboken & Passaic Street Railway Company, Elizabeth, Plainfield & Central Jersey Railway Company, Orange and Passaic Valley Railway Company, United Electric Company of New Jersey. Additional properties were leased as follows, in May, 1904, for 999 years:

South Jersey Gas, Electric & Traction Company, which in turn controlled the Camden & Suburban Railway Company, which in May, 1896, was the merger of the Camden Horse Railroad Company, organized in 1889, and the West Jersey Traction Company, organized in 1894. Additional companies subsequently were leased as follows: Essex & Hudson Gas Company, Hudson County Gas Company, Paterson & Passaic Gas & Electric Company, South Orange & Maplewood Traction Company, Plainfield Gas & Electric Company, January, 1904; Central Electric Company, Middlesex & Somerset Traction Company, May 1, 1904; Raritan Traction Company, May 1, 1904; Carteret Electric Light & Power Company, March, 1905; Gas & Electric Company of Bergen County.

The development of the properties leading up to some of the companies now but one member of the family now called the Public Service Corporation of New Jersey, is interesting. Some of the railways had their beginning in the 60's, but as the scope of this article is more on the electrical development side, the growth of the light and power business in and about Jersey City and Newark is presented.

Historically, the earliest in the electric lighting field of all the constituent companies now comprising the Public Service Corporation of New Jersey was the Newark Electric Light & Power Company. This company was organized February 21, 1882, and began business as the licensed agent of the United States Electric Light Company, manufacturers of arc and incandescent apparatus.

The company first began business by running a few machines in the United States factory. Power was subsequently leased in the engine building shop of the Hewes & Phillips Iron Works, from which place a few arc lights were operated until the first station was completed on Mechanic Street sometime in the winter of 1882-3.

### FIRST STATION.

The first installation in this station was a Watts-Campbell Corliss engine of 400 hp and four horizontal tubular boilers. All of the earlier business was in arc lighting, the dynamos consisting of a miscellaneous lot of machines, ranging from 2 to 10 lights each in capacity. Soon after the completion of this station an order was placed for a 20-light shunt-wound United States machine.

It was not until 1886 that the first incandescent lamps were supplied with current from this station. The dynamo was a 70-volt machine of the United States type, having a capacity sufficient to deliver power to 125 lamps. The first lamps to be used were in the house of the Essex Club on Park Place.

The station building was enlarged and improved and new apparatus started in the winter of 1886-7. The company began operating at this time a day service for incandescent lighting, using for this purpose an engine of 30 hp, which was sufficient capacity for the day load of the year 1887. From this small beginning developed the Public Service Corporation of New Jersey, with its 75,000 kw capacity, and present increase in the new Marion Station on the Hackensack meadows of 13,000 kw in turbo-generators.

Beginning with 1887 the business grew steadily, but very slowly. All kinds of inducement, arguments and guarantees had to be made to secure a customer, and even then electric light was considered the height of luxury by the consumer.

During 1886 two rival companies started an arc lighting business in Newark. The first was the Newark Schuyler Electric Light Company, which was started as an offshoot of the Waterhouse Electric Manufacturing Company, afterwards merged into the Schuyler Company; the second company was the Thomson-Houston Electric Company, started as a sub-company to the parent concern manufacturing Thomson-Houston dynamos. The two newer companies immediately started in to secure business at any price. Competition was strenuous and at one time prices were reduced so that arc lights were supplied at $1.50 a month on yearly contracts, a rate never since equalled under any condition of power in the electric lighting business. Such ruinously low prices during a period of over six months forced both of the smaller companies out of existence, and they were subsequently bought in by the Newark Company, the Schuyler Company being taken in during September, 1889, and the Thomson-Houston Company in June, 1890.

Shortly before the acquisition of these two companies the Central Power Company was organized in the city of Newark for the purpose of supplying power solely for manufacturing purposes. This company was promoted by interests identified with the Daft Electric Company, which took on a business of about 200 hp, and was sold out under foreclosure with the old Daft Company, which owned a majority of the business, some time in 1893. The assets of the local company were purchased by a few gentlemen in Newark and operated independently until the end of the year 1896, at which time they concluded to give up the business and sold out to the People's Light & Power Company.

The People's Light & Power Company, while organized in 1894, did not begin operations of any kind until the early summer of 1895. At that time a majority interest in the Newark Electric Light & Power Company, having been previously acquired by New York capitalists, was offered for sale and was purchased by the People's Light & Power Company and immediately reorganized.

In the fall of 1895 the People's Company bid for the public lighting of Jersey City, which at that time had but 163 arc lights on its streets, operated in about equal proportions by the Jersey City Electric Light Company and the Hudson County Electric Company, two corporations which were doing a small amount of business in Jersey City and Bayonne. The People's Company, acquiring the street arc lighting in the central section of Jersey City by virtue of the lowest bid, forced the two other companies to build a large amount of new line on the outskirts of the city to carry the lighting acquired under their respective bids, the Jersey City officials having determined upon an extension of its street arc lighting. Under these forced conditions the Jersey City Electric Light Company and the Hudson County Electric Company each soon negotiated with and sold its properties to the People's Company, for each had been seriously hurt financially by the loss of the profitable section of the city's lighting.

A similar method to that in which the Jersey City Electric Light and the Hudson County Electric properties had been acquired was followed in the case of Harrison, and in like manner the plant and property of the Excelsior Electric Company was acquired. In Orange the plant and property of the Essex County Electric Company and in East Orange the plant and property of the Suburban Electric Light & Power Company were voluntarily offered to and purchased by the People's Light & Power Company. Other plants were acquired from time to time; in 1896 the Montclair Light & Power Company, Consumers' Electric Light & Power Company, Edison Electric Light & Power Company and in 1898 the Kearney Electric Light & Power Company.

In 1897 the People's Company bid on the lighting of the town of Irvington in competition with the Newark Gas Company. The refusal of the gas company to extend its mains for private consumers, except in the event of their securing the municipal contract, necessitated an offer on the part of the People's Company to supply gas to such residents of Irvington as desired to use gas for private lighting, and whom the local gas company declined to serve. For this purpose the People's Gas Company was organized and a franchise secured for the manufacture, distribution and sale of gas throughout Irvington and the adjoining townships; but in the meantime the old gas company decided to extend its mains and supply such customers as applied for the use of gas.

It was in 1899 that the People's Light & Power Company was merged with the United Electric Company of New Jersey with other neighboring light, power, railway and gas companies, and then in 1903 this resultant company became merely a part of the larger corporation. The Central Electric Company erected its central plant at Metuchen for the supply of current to Metuchen, Highland Park, New Brunswick, Perth Amboy, Rahway, Woodbridge, Bound Brook and Dunellen.

This company was a consolidation of the Middlesex Electric Company, Edison Electric Illuminating Company of New Brunswick, Raritan Electric Light & Power Company, of Perth Amboy, Rahway Electric Company and Bound Brook Electric Light, Heat & Power Company.

The equipment of the generating stations replaced by the new central plant consisted entirely of small belted units and the plants were so situated that coal had to be carted at a cost of 28 to 40 cents a ton and in every case except Bound Brook, water had to be purchased for the boiler supply. Sub-stations superseded the plants and modern units were installed in the central plant, as given later on.

The Gas & Electric Company, of Bergen County, in 1899, brought in under one management the lighting companies of Hackensack, Rutherford, Richwood and Englewood and plans were carried out to operate everything from the Hackensack plant. The old plants were abandoned and sub-stations fitted up in their stead, each of which handle the street and commercial lighting over a territory allotted to them, and a reduction from the prevailing price invariably has meant increased consumption. With, for example, a cut in rate, the consumer feels he can use more current, and not merely an increased amount to make up for the decrease in rate, but an additional amount as well.

The organization and the affairs of each constituent company are kept separate. The book-keeping and costs and income of each are separate just as much as though the concern were independent, and separately owned and governed.

The great resultant advantage to the people served with light, power and railway is better assurance of continuity of service, practically universal transfers and readjustment of rates for light and power to a more equitable basis. History has shown that the readjustment of rates for light and power, though sometimes reluctantly given by the companies, result in increased income. It is a singular fact that people want light.

### ELECTRICAL DISTRIBUTION.

The electrical distribution problem confronting the Public Service Corporation of New Jersey after its acquisition in June, 1903, and subsequently, of what were fifty odd plants supplying electric light, power and railways, is enormous. Twenty central stations and twenty-four sub-stations comprised the list of active plants, and some of these had previously replaced a multitude of others since the history of applied electricity began.

The capacity and equipment of the present active stations and sub-stations is given in the following pages, but the newly completed plant of 13,000 kw capacity, with its provision for enlargement to 64,000 kw, described in a separate article, is an earnest of the units of high economy to be located at tidewater points. Thus the future will develop the further abandonment of the comparatively inefficient smaller stations and the increase of sub-stations for the supplying of electric light, power and railway energy.

An outline map of the State of New Jersey is given in Fig. 1. upon which the territory served by the electric lighting and power station is divided into three groups. For convenience these groups are designated Northern Jersey, Central Jersey and South Jersey. The generating stations and sub-stations are located on the separate maps of each group represented in Figs. 2, 3 and 4.

The stations are represented by solid circular spots and square spots, the sub-stations by hollow squares and by circles. The solid spots are stations in use now and which are to be retained. The solid squares represent abandoned stations or stations to be abandoned. The circles represent present sub-stations and the outline squares represent sub-stations abandoned or to be abandoned. The circles with a center line are sub-stations in course of erection. The letter *P* signifies power, *R* and *L* signify railway and light, respectively. Thus when *R* and *L* are indicated, the station or sub-station is for railway and light.

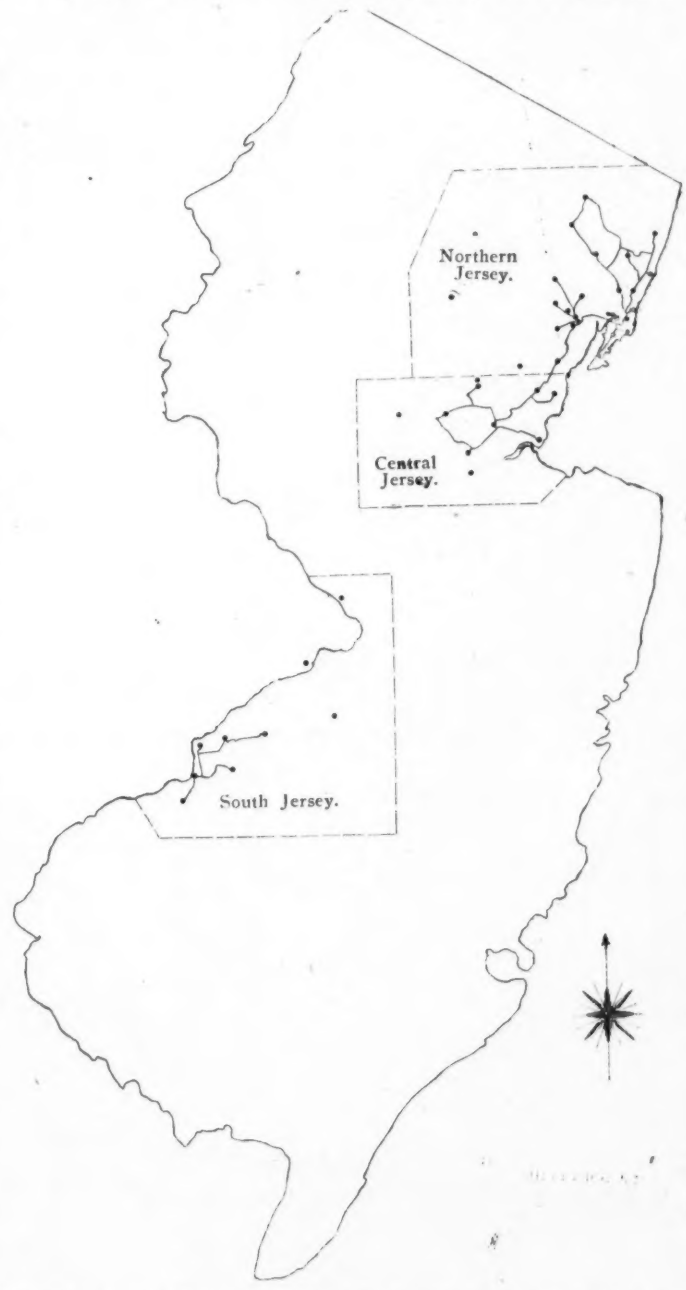



FIG. 1.—MAP OF TERRITORY COVERED BY PUBLIC SERVICE CORPORATION OF NEW JERSEY.

It will be noted from an inspection of these district maps that many generating stations are being replaced by sub-stations, and in some instances present sub-stations are being substituted by new sub-stations in better locations. This, of course, is to place them in the centers of distribution occasioned by the readjustment of load as planned by the engineers.

### NORTHERN NEW JERSEY.

In the Northern Jersey group are comprised the new Marion station on the Hackensack River, between Jersey City and Newark;

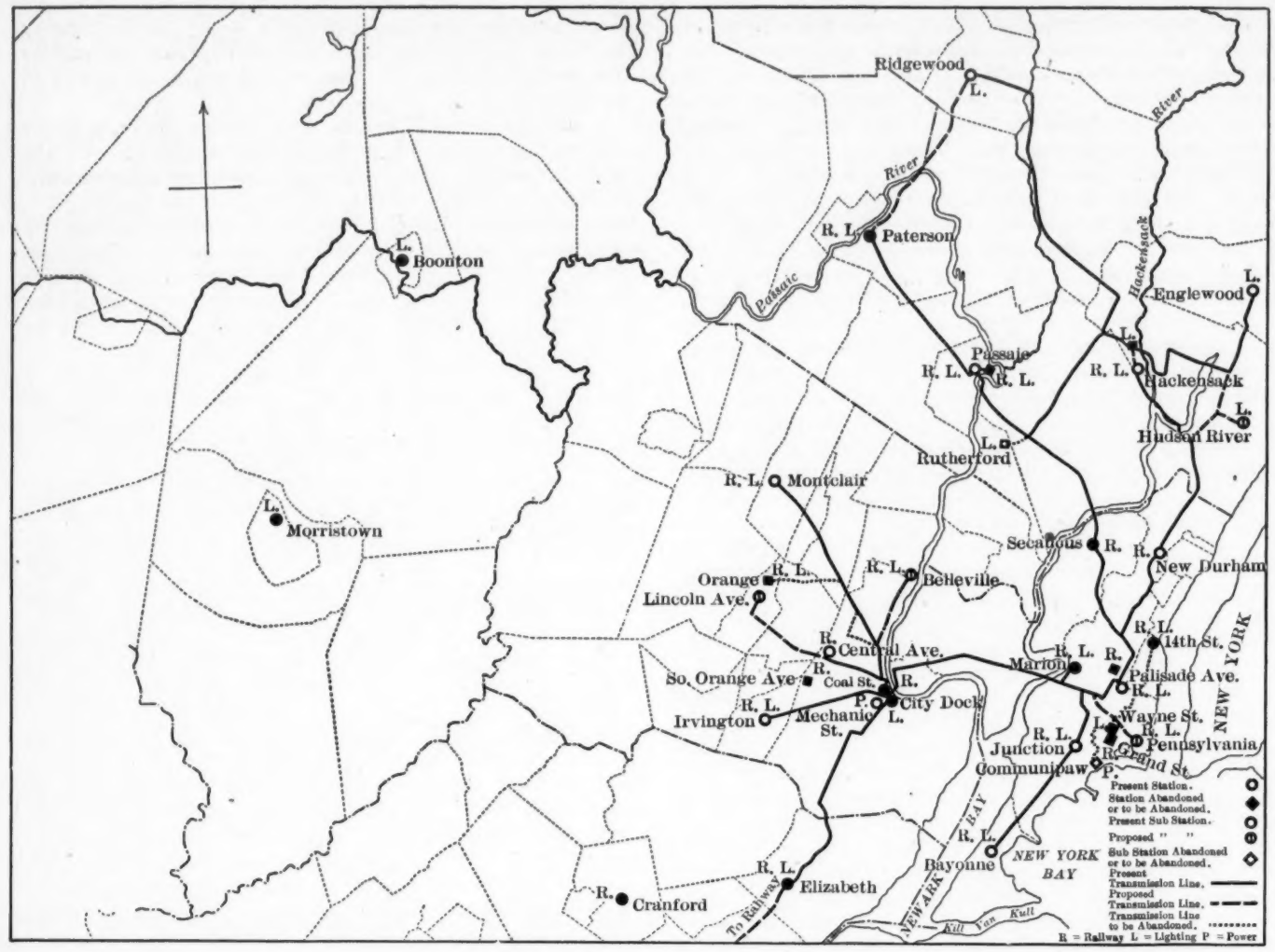



FIG. 2.—MAP OF NORTHERN JERSEY DISTRIBUTION.

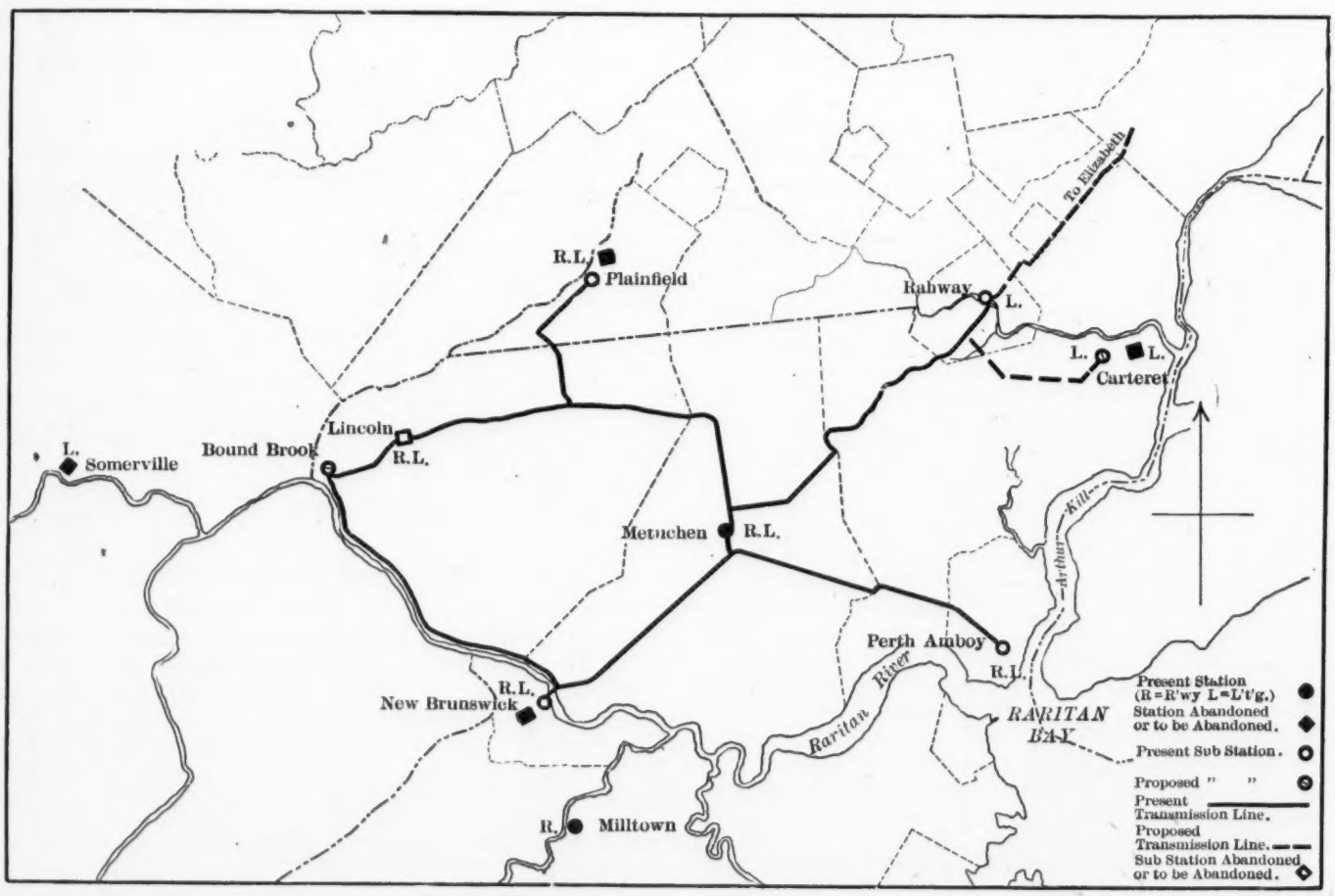



FIG. 3.—MAP OF CENTRAL JERSEY DISTRIBUTION.

ELECTRICAL DISTRIBUTION SYSTEM OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY.

Coal Street and City Dock stations, on the Passaic River, in Newark; the Fourteenth Street station in Hoboken, on the Hudson River; the Secaucus station, near the Hackensack River; the Paterson station, on the Passaic River; the Elizabeth station, at Elizabeth, and two small independent stations at Morristown and Boonton. It will be noticed that all these stations except the two last and Hoboken are tied together by virtue of line connections each to the other, so that it would actually be possible to supply energy from Paterson to Elizabeth through the substation at Passaic, the Secaucus station, the Pallisade Avenue sub-station in Jersey City, Marion station and the Newark stations at City Dock and Coal Street. This tying in of these stations has proved highly useful and guarantees practically continuous service by eliminating interferences in service from breakdowns in any of these stations.

In general the system of lighting circuits is 60-cycle alternating. The direct-current railway system is fed direct by 550 volts direct current, and by transformation from 13,200 volts, 25-cycle, alternating-current generators. This diversity of the generating supply was determined by the large investment in both classes of apparatus, about $2,000,000 having been invested in 25-cycle machines for railway distribution just prior to control of the various companies by the Public Service Corporation. Therefore, it was determined to carry in future plants and extensions both 60-cycle and 25-cycle apparatus. Thus in the new plant at Marion is 10,000 kw capacity of 25 cycles and 3,000 kw capacity in 60 cycles, the former for railway and the latter for lighting and power work.

The Coal Street station at Newark contains the following generator and engine units:

Three 850-kw Westinghouse, 550-volt, direct-current generators, direct-connected to a Watts-Campbell cross-compound engine.

FIG. 4.—MAP OF SOUTH JERSEY DISTRIBUTION.

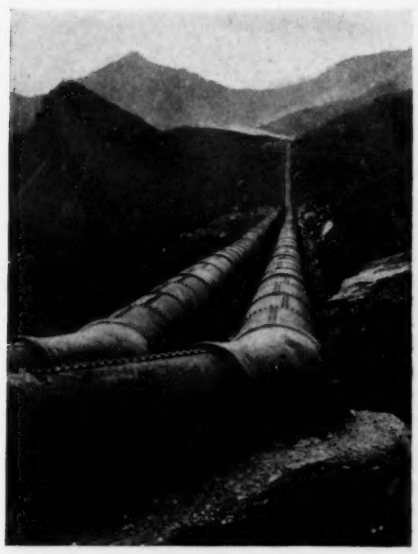
One 350-kw Westinghouse, 550-volt, direct-current generator, direct-connected to an Allis cross-compound engine. Five 1,800-kw General Electric, 13,200-volt, 25-cycle, three-phase generators, each direct-connected to vertical cross-compound Brown Corliss engines. One 3,000-kw General Electric Curtis turbo-generator, 6,600-volt, 60-cycle, three-phase. There is one 1,000-kw General Electric, 25-cycle rotary supplied by step-down transformers and providing 600 volts direct current. All the engines operate condensing. The boilers are Babcock & Wilcox, there being 15 of 250 hp and 12 of 500 hp each, run at 155 lb. pressure.

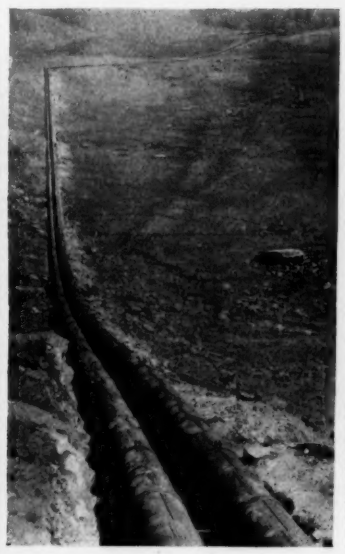
# The First British Hydro-Electric Power Transmission.

MANY circumstances have conspired to hinder the advance of the hydro-electric principle of power transmission in Great Britain. Perhaps the first of these is that in many industrial districts where the demands for power are great, the supply of coal is also ample. Lancashire, the great textile district, for example, is also a great colliery district, and in Newcastle, coal shares the position of principal industry with iron and shipbuilding works, while Glasgow, the enormous center of iron and shipbuilding work, is adjoined by innumerable collieries. These three serve as examples of the way in which the principal power-using industries in Great Britain are served as regards fuel, and the progress, which is already becoming marked, of the larger power distribution companies in England and Scotland, is not in the majority of cases owing so much to actual economy in prime cost due to reduction in fuel consumption as to the greater advantages which electricity offers from other points of view. In the textile industry, for instance, steadiness of drive and cleanliness are advantages which tend to turn the scale in favor of the use of motors.

In North Wales, however, the above considerations do not hold. Clustering round the great mountain (that is, great from an insular point of view, being the highest mountain in Wales) of Snowdon is an industry which utilizes a great amount of power, namely, that of slate quarrying. The slate outcrops on the mountains in enormously thick veins, and in some places the whole side of the mountain is actually hewed away in working it. In other places it is impossible to hew away the side of the mountain in this manner, and, in consequence, enormous weights of slate have to be hoisted to the top or else hauled through galleries outwards to the side of the mountain. As on an average only one ton of actual roofing slate is obtained from every 28 tons of material worked, and as in some of the larger quarries as much as 40,000 tons of slate per month are handled, it will be seen that the power requirements are great, thus providing an excellent occasion for the establishment of a power distribution scheme. Another factor is that coal or fuel of any kind is extremely dear owing to the difficulties of transport, the conditions in this connection being almost analogous to those prevailing in Western United States.

FIG. 5.—VIEW OF PIPE LINE.





FIGS. 1, 2 AND 3.—VIEWS ALONG THE PIPE LINE.

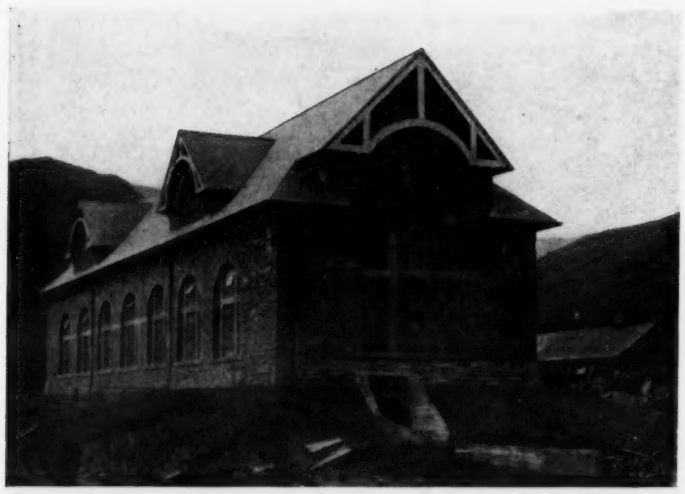


FIG. 4.—POWER HOUSE.

The slate producing area covers nearly 200 square miles, so that the case for high-tension transmission is obvious. As to the generation of power, the Snowdon region constitutes the center of what is known as the Atlantic depression, in which the rainfall attains the extraordinarily high average figure of over 200 in. per annum, thus furnishing ideal conditions for the establishment of a hydro-electric power plant, which furnishes the subject of this article.

The water supply is drawn from Lake Lyddaw, which stands some 1,400 ft. above the sea level, and is conveyed by a pipe line about two miles in length, to the power station in the Gwynant Valley, the effective head being between 1,100 and 1,200 ft. Owing to the boggy nature of the soil in many parts and to the almost entire absence of roads worthy the name, the difficulties of conveying the heavy steel pipes, penstock parts, etc., to

position and of anchoring them, have been very great. The work, however, is now approximately complete.

The power station contains four 1,500-kw Peebles high-tension, three-phase alternators, each driven by a Pelton wheel, and accommodation is provided for two additional sets before it will be necessary to extend the building. An ample further supply of water power is also available, as, should Lake Lyddaw not provide all that will be later required, Lake Glaslyn, standing some 550 ft. higher, can be tapped.

Another feature in which the scheme is unique in Great Britain is that it is the first example of the extensive use of high tension overhead conductors, the Board of Trade having previously imposed very severe restrictions on this method of transmission, but has shown a reasonable and progressive spirit throughout in connection with the North Wales plant. At present there are some 30 miles of transmission line of 10,000 volts completed, and the total length of lines will eventually approach 140 miles. The difficulties of running the line, as in the case of the pipe line and mains, were great for similar reasons, bog being one of the worst conditions to be contended with.

It is interesting to note that already before the power supply has commenced, several of the largest quarries, including the Oakeley and Darbishires, have contracted for electric power, and the power company will open operations with a load of

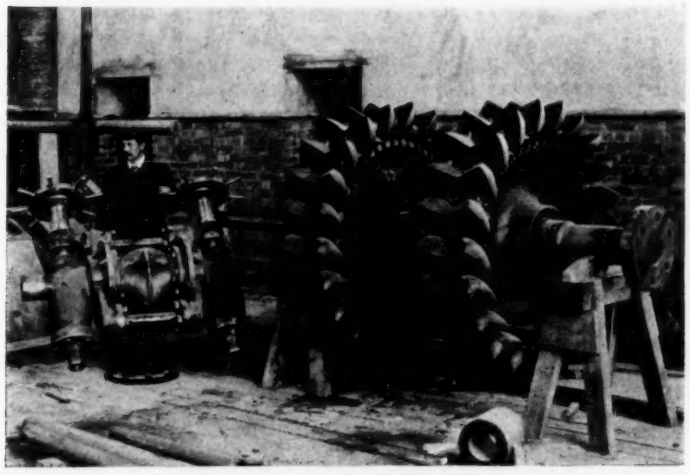


FIG. 6.—PELTON WHEEL.

4,000 hp on its mains, it being a unique record with British power companies. In addition to supplying quarries, mills and other users of power in the neighborhood, the company will run a three-phase electric railway some 20 miles in length, which will eventually connect Portmadoc, on the southern side of the northern promontory of Wales, with Carnarvon, a prominent junction on the north, where it will join the main line running from England to Ireland by Holyhead. This railway will not only supply a great want in furnishing a means of transport from the quarries down to the coast for shipment of their material, but it will also, in the summer especially, attract a large passenger traffic, as the Snowdon range is rightly regarded by beauty lovers as one of the finest in the United Kingdom in point of view of scenery, and the new railway should do much to open it up to the public.

The contractors for the entire plant were Bruce Peebles & Co., Ltd., of Edinburgh.

## Electro-Optic Properties of Carbon.

The electromagnetic theory of light suggests that certain specimens of carbon, possessing a high electric conductivity, might possess a high reflective power for rays of great wave length, provided the passage of electricity through them takes place in the same manner as in metals. In a recent issue of *Physikalische Zeitschrift,* Mr. E. Aschkinass states that he has found that certain carbons possess a reflective power of 100 per cent for waves of the Hertzian order. But the influence of the good conductivity is already sufficiently apparent in the infra-red spectrum. In gas carbon, Siemens arc lamp carbon and graphite, the curve of reflecting power rises immediately on leaving the visible spectrum and continues to do so until the Hertzian waves are reached. Thus for polished gas carbon the reflective power is 4.4 at 0.589 $\mu$, and 56.5 at 51.2 $\mu$. Anthracite also exhibits considerable reflective power in the infra-red, but this never goes beyond 14, even for Hertzian waves. This anomaly is to be expected in consideration of its comparatively low conductivity. It, therefore, also transmits some of the waves, and its refractive index for infinitely long waves, as calculated from the reflection, comes out at 2.2.

## An Ice-Making Electric Light Station in Florida.

BY JAMES F. HOBART.

THE Plant City Electric and Refrigerating Company, which has been in business about two years, operates a load of 1,000 lights all night and every night, using a 37-kw two-phase alternator of a somewhat old type. This machine is badly overloaded and a new 90-kw, direct-connected, three-phase revolving-field generator is to be installed in the near future.

A 150-hp boiler of the locomotive type furnishes steam to a 150-hp automatic, high-speed Harrisburg engine, connected by belt direct to the generator. Water is supplied to the boiler from a number of surface wells, as the water from a driven well 600 ft. deep, on the premises, is so impregnated with lime and other substances, that it cannot be used in the boiler. The only use made of this fine source of water supply is to cool the ammonia after compression has taken place, the water for freezing being obtained from driven wells which form the source of the city service.

For refrigeration a straight absorption system is used, a 100-ton Henry Voght machine being installed, necessitating the running of nothing more than a pump to handle the ammona and another pump to deliver the cooling water from well to tower.

Wood is used for fuel, which has to be hauled by teams from two to four miles. The exception, however, must be made to considerable refuse from a crate mill nearby, the refuse being very light stuff, shavings and pine veneer, which burns quickly and works well with the heavy pine cordwood and slabs from wood lot and mill.

With the present electric load, the lighting plant just about pays expenses, a considerable portion of the load being street lamps and most of the remainder are house and store lamps, which are left burning all night, no matter whether they are useful or not. The new generator ordered will greatly increase the profits of the electrical end of the business, as at present additional customers cannot be connected up and many are waiting with their buildings already wired.

The source of profit, therefore, is at present solely in the ice-making end of the business. It is estimated that during the ice season, extending from February to October, the income from ice is three times that from electric light. The part of the year named is when vegetable and fruit shipments are made to the north and west, requiring a great deal of ice. Every crate of strawberries and every package of perishable fruit receives its complement of ice before leaving the shipping platform. The market for ice is thus steady and uniform and does not depend much upon variations of local temperature.

During the ice season above mentioned, no part of the machinery in the station is used in common for light supply and ice making, except the steam boiler. Even the attendance is separate and distinct, and aside from the very small saving of first cost of a boiler, there is in this case little saved by the combination of ice and electricity, as separate crews have to be maintained to handle both sets of machnery and output.

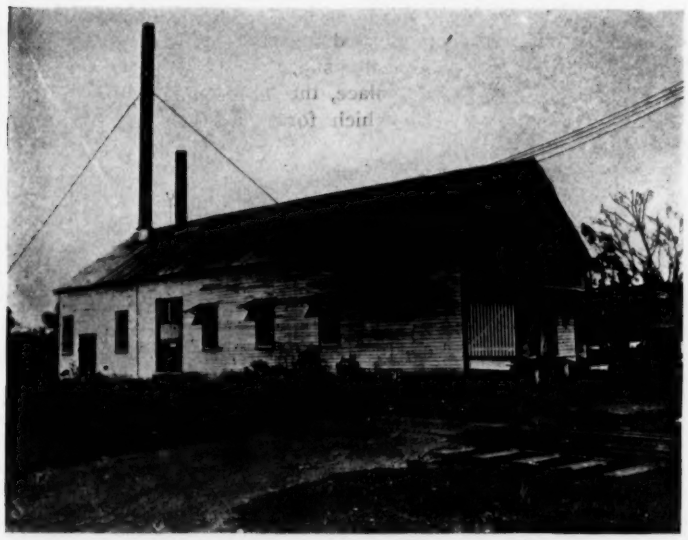
From October to February a different arrangement is followed and a very profitable one too for the owners of the plant. During the months named, only about 10 per cent of the ice required in the summer months has to be made, and the ice-making is turned over to the night gang; in the daytime only a fireman is required, who keeps the temperature at the proper point in the freezing tanks and incidentally generally looks after things.

Probably no better summing up of the situation can be had than

to quote the words of Mr. C. E. Stuart, the general manager of the plant, when he remarked to the writer that the advantages of combining two such enterprises in a small place is about as follows:

"In case it is desired to run the ice plant at night, the same force of men can run both that would be required to run the light plant only, and the same manager or superintendent of business can just as well attend to both as to one. So far as the running expenses are concerned, if it is not desired to run the ice plant simply in the day time, there would be no special advantage in the combination; but when we do not wish to run it day and night, we run it at night while we are fired up for the lighting plant. There is no special mechanical arrangement that is common between the two plants except that we use the same boiler. You can form your own conclusions from the above what the advantages of such a combination are. If the two plants in Plant City were owned by separate people there would probably be required at least two more men than now employed in the combination; and at such times as the demand for ice requires the running on only half time there is very little additional expense in the way of fuel, as it requires little more fuel at night to run both plants than it would to run the electric plant alone."

The superintendent of the plant, Mr. A. E. Ellis, a mechanical and electrical engineer, assumes control of the power machinery daytimes, thereby rendering the use of a day engineer unnecessary except when the ice plant is running full capacity. The day



ICE AND ELECTRIC STATION, PLANT CITY, FLA.

watchman is a fireman, who attends to the steam supply when the full capacity of ice making is needed; therefore the services of a day engineer and the necessary men to handle the ice and water, are all the extra help needed for day running and this practically doubles the night force, leaving out the services of the superintendent, which are regarded as an overhead charge.

From the foregoing, the following deductions are made: Consider the earning capacity of the lighting plant as 100, and the expenses of operating also as 100; the full earning capacity of both ice and electric plants is 400 and the expense being doubled by the day force, extra fuel, etc., becomes 200. Taking this view of the situation, the following table expresses the profit of running the plant under various conditions:

| | Output. | Expense. | Profit. |
|---|---|---|---|
| Electric plant alone | 100 | 100 | 000 |
| Electric plant and ¼ ice capacity | 175 | 100 | 75 |
| Electric plant and ½ ice capacity | 250 | 100 | 150 |
| Electric plant and full ice capacity | 400 | 200 | 200 |

From the foregoing, it is evident that, while ice making is a benefit to the small electric plant owner, it is not a cure to all his ills, and he is still in the market for something which will keep his machinery busy during the day. As far as ice-making is concerned, it is good for the electric man only as far as it gives full employment to the engineering force, and in the case of larger plants, where the engineer is fully occupied in taking care of the electric machinery and engines, there would be necessary an extra force to take care of the ice making; therefore the 150 profit for half ice capacity would be cut down to 50 or even less by the employment of the ice makers necessary to run the plant.

It is evident from the above figures that the ice making should be encouraged to the extent of the night engineer's capacity to look after that portion of the business. For instance, could the ice-making capacity be increased one-half, and the night engineer still be able to take care of it, the tabulation would read:

| | Output. | Expenses. | Profit. |
|---|---|---|---|
| Electric plant and ice capacity increased one-half | 325 | 100 | 225 |

It will, therefore, pay to increase the ice-making capacity to the limit of operation by the present engine-room and boiler house force, also to increase the electric output, provided there is a market for the same.

For the central station the ideal requirement is a day load which will require the use of the same machinery employed at night in producing light. It is in many cases not desirable to have to put in a second plant consisting of entirely different machinery. Taking this view of the case, it is in order for the lighting company to create a demand for day current, both light and power. In case of the plant above described, the current is turned on about 4:30 p. m., and is cut off as soon as it is light in the morning. Thus there can be no demand created for day current as long as the present method of shutting down daytimes, is followed. Add to the day ice-making, a small generator and keep alive certain circuits in house and factory, and very soon a demand for considerable day current will be the result.

The conditions call for an all-electric day load, therefore the electric light man should look to electrolysis for his salvation. In that direction he can apply as great or as small a load as he pleases and by the addition of one machine, a rotary transformer, he can fully equip for the work. Failing to find other business, the manufacturer of soda, sodium and chlorine from common salt, might offer a commercial success and the manufacture of artificial mineral waters by electrolysis may also afford a field. In many parts of the country, waters highly charged with various salts might profitably be handled as a day load. In this State (Florida) almost any kind of water, from that containing magnesia, to lime and sulphur, can readily be obtained by drilling wells of various depths, and the substances to be obtained therefrom by electrolysis present possible sources of profit.

## The London Power Situation.

By T. H. Minshall.

Attention has already been directed to the question of the electrical supply of London which in the forthcoming session of Parliament is about to engross public attention. It will be remembered that a number of schemes for consolidating the supply which at present is given from over seventy generating stations, were brought forward last session, and the most important of these, that known as the Administrative Power Company, after passing the committees of both Houses, just failed to become law owing to the close of the session. The evidence given in support of that bill, to which allusion was made in these columns at the time, was a revelation to engineers of the enormous saving of capital and working expenses which could be brought about from concentration; whereas the plant and buildings at present installed in London for electrical purposes stands at £51 per kilowatt, it was shown that this power company was in possession of actual tenders enabling it to erect a station of 90,000 kilowatts at a cost of £8.4 per kilowatt. Another startling fact was brought out regarding the working costs, for it was shown that instead of 14 shillings and 15 shillings a ton for coal, which is the price paid by the present electric lighting companies, coal could be delivered on site in the lower reaches of the Thames for 8 shillings per ton. The net result of this concentration was that the company undertook to supply current at an average price of ¾d. per unit, the present rate being 4d. But it must be remembered that at the present time the bulk of the supply is for lighting purposes—in fact so little is used for power that 96 per cent of the power used in the factories of London is derived from private installations on the users' premises, while the existing companies and municipalities only sell about 5 per cent of their output for power purposes. These facts and fig-

ures made such an impression that a crop of rival proposals are being brought before Parliament next session.

The London County Council has decided to promote a bill for the purpose of supplying energy in London, and raises the cry of "No Monopoly." The Administrative Power Company's bill comes up again for confirmation by Parliament in the form in which Parliament left it last year. The County Council's scheme is for supplying electricity in bulk, but, with a view to securing the support of the present lighting authorities, it does not propose to give any detailed supply. A start is to be made by supplying from the large tramway station which the Council already owns at Greenwich and a second station is to be built at Battersea. The scheme is meeting with violent opposition, more especially in financial circles, the finance committee of the Council itself under the chairmanship of Lord Welby, a leading English financier, having strongly recommended the abandonment of the proposal, while commercial circles in the city look with alarm upon the increase of the debt of London which is already approaching £100,000,000. Whatever may be thought broadly about municipal trading and the advantages of having street railways and water supply in municipal hands, it is felt to be a very serious step in advance when the municipality undertakes to go in for the supply of electric power, in competition with other bodies, at a time when developments in the methods of production are taking place so rapidly.

Another interesting scheme is one with a powerful financial backing, which proposes to erect a generating station at St. Neots, about 51½ miles from King's Cross in the neighborhood of the Nottingham coal fields, although, strange to say, it is not proposed to build actually in the coal fields, presumably in order to get plenty of water. The current will be generated and transmitted by means of private right of way along the Great Northern Railway up to London, where it is to be taken along the towing paths of the canals. It is proposed under this scheme to give a supply in bulk to the present authorities.

Then, in addition, two of the existing companies in London —the Charing Cross Company and the London Electric Supply Company—seek large powers of supply on the north and south of the Thames respectively; whereas the West End electric lighting companies of London also seek powers to associate with each other. It should be explained that under the present acts of Parliament, all the companies and municipalities supplying electric light are confined to the areas of their own district and are expressly prohibited from giving or taking a supply to or from their neighbors. This, of course, dates from the time when the area of a parish was supposed to be the most economical area, and the bills now being promoted have, many of them, for their object the removal of this restriction, which is no longer of any advantage to anybody.

In addition to the above schemes, several of the municipalities in London who own electric light undertakings are promoting bills enabling them to give or take a supply of electricity from each other. It is difficult to see what will be the net result of all these bills, but it is generally expected that the House of Lords will throw out the bill of the County Council. It may be that Parliament will grant quite a number of them, as they are not necessarily exclusive of each other. The English love of compromise would quite approve of a municipality and a company scheme, both being sanctioned in order that the constant competition should keep them both efficient and insure the customer getting a low price.

One thing is certain, the London situation is very interesting, and it has great possibilities in it, for it is often forgotten that

COMPARISON OF LONDON WITH VARIOUS CITIES.

| Name of City. | Population. | Horse-power connected per 1,000 head of population. All purposes. | Power only. |
|---|---|---|---|
| Boston | 541,700 | 123 | 52 |
| Newcastle | 377,047 | 115 | 49 |
| New York | 2,525,000 | 73 | 35 |
| Frankfurt | 306,000 | 80 | 29 |
| Berlin | 2,285,000 | 82 | 22 |
| Hamburg | 700,000 | 77 | 13 |
| London (Industrial area) | 3,723,770 | 26 | 4 |

London is one of the largest manufacturing cities in the world, having in its factories over 600,000 employees. Moreover, the supply of electricity for the suburban services in London on the great railways would provide an enormous field. Altogether the supply in London at the present time per head is very much less than in other cities as the above table, which is believed to be fairly accurate, will show.

The difficulty is that on the one hand the municipalists would prefer to go on with their present inefficient systems and high prices, rather than permit concentration to take place under a company, while, on the other hand, the commercial community and Parliament generally is not inclined to favor the municipalities in embarking upon an enormous expenditure which, in a few years' time, will amount to many millions in an enterprise which is rapidly developing and requires the greatest commercial push to obtain good financial results. The need for concentration is similar to that which existed in Chicago and Boston, and to some extent in New York a few years ago, and the result will be watched on this side with much interest.

## Central Station Economics in Massachusetts.—II.

PITTSFIELD ELECTRIC COMPANY.

Electric lighting in Pittsfield began to be carried forward on a substantial basis in 1890. The Pittsfield Electric Company, operating in Pittsfield and Dalton, serves a populat on of slightly over 28,000. The officers of the company are: President, Alexander Kennedy; treasurer and manager, W. A. Whittlesey; clerk, W. L. Adam.

The company has one power station, one sub-station and one auxiliary generating plant. The main power house is located at Cottage Row, Pittsfield; the sub-station is at Dalton and the auxiliary station is known as the Van Sickler Water Power, owned by the Berkshire Life Insurance Company. The first-mentioned power plant contains seven 200-hp Bigelow boilers having 33 sq. ft. of grate surface and 1,758 sq. ft. of water heating surface each; two 500-hp Rice & Sargent engines, direct-connected to two 330-kw Stanley, inductor, two-phase, 1,200-volt, 60-cycle, 162-r.p.m. alternators; one 250-hp Harris-Corliss engine arranged for driving two Westinghouse 500-volt, direct-current generators; one Westinghouse, 250-hp engine, driving a 150-kw alternator and a 50-kw, direct-current, 500-volt generator; one Westinghouse 150-hp engine, driving a 50-kw, direct-current, 500-volt machine, and two Knowlton & Kelley engines driving 550 kw of 500-volt generating machinery. Argand blowers of 7 in. size are used under three of the boilers, and the water is measured by Worthington hot-water meters, whose readings furnish a check upon the amount consumed.

A special feature of the power plant is the absence of condensing equipment. The Pittsfield Electric Company heats the buildings in the business section of the city from the railroad station, using exhaust steam at 3 lb. pressure for the purpose. The heating district has a radius of about one-fourth mile from the plant and the work is carried out by the American District Steam Heating Company through two 12-in. mains insulated in wooden logs. The charge is the flat rate of 30 cents per 100 cu. ft. of building per year.

The fires of idle boilers are ordinarily kept banked, but usually one boiler is out of service and cold for the purpose of cleaning. About every seven weeks each boiler is cleaned out. At any time of day the flues can be cleaned by a Vulcan steam-driven soot cleaner. Compressed air is used in cleaning the generators and an oil and waste saving machine of the steam turbine centrifugal pattern is in use. Coal is at present carted from the Boston & Albany Railroad to the plant, but the prospects are that before a great while a sidetrack will be laid and a conveying system installed. Ashes are weighed in test about once a year. Occasionally the fuel is subjected to chemical tests for calorific power. Regular records are kept of the coal consumption per kw-hour, which averages about 5.15 lb.

Of late years the cost of manufacture has been lessened somewhat by the improved load factor resulting from increased output at the main power plant. During the year ending June 30, 1905, the total output was 3,602,232 kw-hours. The operating economy of the station is followed through meter readings at the switchboard, water records, coal, oil and supply accounts.

The card catalogue is used in keeping transformer and meter data, the location, size, make and capacity of each piece of apparatus being listed on the individual cards. A separate card index is maintained for tests and each meter is tested at least once in six months. Westinghouse portable recording wattmeters are used in making service tests.

Drawings and data are filed alphabetically at the main office. The service furnished by the company is delivered over the following kinds of circuit: Commercial lighting, 1,200 volts; single-phase, 60-cycle, alternating; street lighting in Pittsfield, alternating-current, enclosed-arc lamps, 6.6 amp. each; residence lighting, 1,200-volt and 2,200-volt; Dalton lighting, 2,200 volts; power service in Pittsfield, 500-volt, direct-current; power for Pittsfield Street Railway, 500 volts. Circuits are tested daily for grounds and crosses. Large transformers are replacing scattered units on the group loading plan, the largest transformers at present in use having a capacity of 600 lights each. The maximum distance served in this way is set at about 600 ft. Three-wire secondary distribution is largely used. The power house fire protection scheme includes stands of hose and chemical extinguishers in the boiler and engine rooms.

The economy of distribution is promoted by the use of large transformers, which are placed in brick houses in the rear of

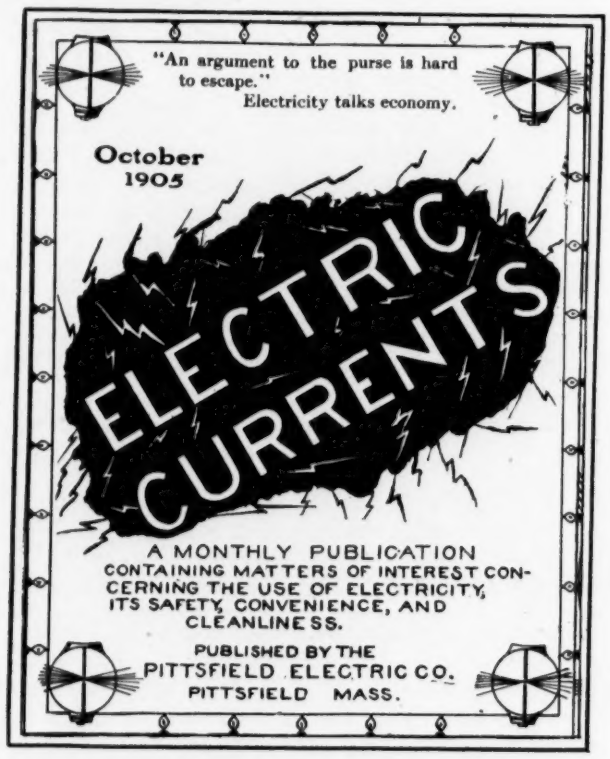

"An argument to the purse is hard to escape."
Electricity talks economy.
October
1905
ELECTRIC CURRENTS
A MONTHLY PUBLICATION
CONTAINING MATTERS OF INTEREST CONCERNING THE USE OF ELECTRICITY, ITS SAFETY, CONVENIENCE, AND CLEANLINESS.
PUBLISHED BY THE
PITTSFIELD ELECTRIC CO.
PITTSFIELD MASS.

FIG. I.—PITTSFIELD ELECTRIC COMPANY.

blocks in the center of the town, with meters and cut-outs inside these shelters. This permanent construction offers many advantages over the older plan of mounting large transformers more or less inaccessibly upon poles, sometimes of great height and always of much inconvenience when emergency work has to be done. The smallest size of wire used on the overhead system is No. 6 B. & S. Primary lines leading to emergency transformers at mills are equipped with oil switches at the mills, to save idle losses.

During the past three or four years a great deal of work has been done in the way of replacing air-cooled by oil-cooled transformers, the better regulation of the latter being an important reason for the change. Ultimately the commercial lighting circuits will have their potential raised to 2,400 volts all over the system. At present booster transformers raising the pressure from 1,200 to 2,400 volts are in use in the outlying districts.

The telephone is largely used by the company, and the chief engineer of the power house has an instrument maintained in his home at the company's expense. In case power is desired by a party located outside the main lines of distribution, the new customer pays the cost of extending the line, complete. He is then credited with the cost of power used until the line has been liquidated, when the circuit belongs to the company. In other words, the customer is given free power until the cost of the line has been met by his current consumption.

Standing advertisements are used in the local press. With the monthly bills the company mails a publication of its own called "Electric Currents" (Fig. 1), the purpose of which is to acquaint customers with new departures in the use of electricity. During the Christmas season a neat folder pointing out the advantages of electrically-lighted Christmas trees was distributed. New business is canvassed by two solicitors and the foreman of interior wiring. The company does not advertise on poles or billboards, but a Maltese cross of galvanized iron is placed on each of its poles for the convenience of employes. The company uses an electric sign at its offices, with fixed name.

Bills are rendered monthly to customers. For any month that the meter does not register at least 5 kw-hours, no bill for current is rendered, but a net charge of 50 cents is made for maintenance. For electric arc and incandescent service the rate varies from 20 cents per kw-hour up to 50 kw-hours, inclusive, falling gradually to 10 cents per kw-hour for a consumption of 750 kw-hours or over. Ordinary lamp renewals are made free to all customers, but "Hylo" lamps are supplied at 25 cents each. A discount of 15 per cent is allowed on all bills paid before the 15th of each month. When electric signs consume not less than 480 watts each, a charge of 8.3 cents per kw-hour is made, provided the signs are owned by the customers. A special contract is made when the sign is supplied by the company.

The rate for power for motors varies from 10 cents per kw-hour below 50 kw-hours, to 3.2 cents for 2,000 kw-hours. A discount of 20 per cent is allowed from the above rates to users of power purchasing their own motors, and a discount of 5 per cent is allowed on all bills paid before the 15th of each month. When a customer uses a motor belonging to the company a minimum charge of $5 per month is made. If the meter registers in any one month less than $5 worth of current, the meter reading is billed and the difference between this amount and $5 is added. When a customer uses his own motor, an investment charge of 50 cents is made per month in case the meter does not register at least 10 kw-hours. In the case of very large customers using electric signs a time switch is installed. Between 5 p.m. and 9 p.m. the full rate is charged, with half rate at all other times. For electric heating service a flat rate of 4 cents per kw-hour is charged, with separate metering.

Gas competition is met by the Nernst lamp, the high efficient incandescent and the "Meridian" lamp. Small arcs of 6.6 amp. size are used to a considerable extent in store lighting. In renewing lamps free the bulbs of the old ones must be unbroken and the customer pays for the first installation. Every three months the customers are supplied with complaint postal cards which serve to keep the company in touch with the condition of the equipment. The solicitors also freely advise customers how to get the best results from their apparatus. In the offices labor-saving devices are used to facilitate the work of the accounting department.

## Notes on Central Station Business at Galesburg, Ills.

The Galesburg Railway & Light Company, which also controls the gas plant in Galesburg, built recently a large, economical generating station, with a view of taking care of the electric lighting load in Galesburg and supplying projected interurban roads promoted by the McKinley syndicate, which also controls this company. With the abundant capacity which the new station afforded, the company started out recently with an excellent opportunity to increase business, and this was the more true because the former management of the gas and electric company had been rather indifferent to the possibilities in the development of the electrical end of the business.

What great strides have been made in the past year in the way of increasing the electric load without hurting the gas business can be judged from the statement of the general superintendent,

Mr. R. A. McLaughlin, that the power load is now double that of a year ago. Twenty months ago there were only 6,000 16-cp equivalent incandescent lamps connected. There are now 14,000. The number of customers has increased from 800 to 1,100.

In the getting of new business it is notable that the company finds it necessary to push much harder on the gas end of the business than on the electric end. The electric business seems to come easier and costs less in the shape of soliciting and advertising to secure. The gas campaign is, of course, being concentrated mainly on gas stoves and ranges. The company employs one solicitor, and Mr. McLaughlin himself, as he has opportunity, works up new power business, as that class of work frequently requires considerable engineering and technical knowledge. This is in a city of about 20,000 inhabitants.

At the office, a set of cards is kept, each card showing the name and address of a customer, the kind of service, gas and electric, that he is now taking and indicating the possibilities of securing additional business. When a customer has been secured for all the busness that is considered possible, the card is marked complete and filed away, only those cards being kept out which apply to customers upon whom it will pay to do some soliciting.

One of the best advertisements the company has is its office, which is also a waiting room for the street railway system. It is brilliantly lighted at night with frosted bulb lamps studded around the edges of the ceiling and large, high-efficiency incandescent lamps in the center. The effect is very pleasing and gives a wealth of illumination without glare, which cannot but favorably impress any one entering the room and remind him that he is in the office of an electric lighting company. Electric and gas appliances are on display. Around the sides of the room, on an advertising rack about the size of that employed in street cars, are placed rows of signs advertising gas and electric business in short terse sentences. A white metal ceiling is employed in this room, which adds to the general effect of cheerfulness and good illumination.

The company gives occasionally demonstrations of cooking by gas at a room in the rear of its office. These demonstrations could, of course, if local conditions seemed to justify it, be extended also to electric heating devices. Sometimes at these demonstrations the company gives out some kind of souvenir advertisement. One of these which we have in hand bears the inscription on the cover: "Forty Complimentary Pointers from the Galesburg Gas & Electric Light Company." Inside this folder is some advertising matter for gas ranges and the forty pointers in the shape of forty needles of assorted sizes, which the housewife is sure to take home and use.

The rate for customers signing a three-year contract is 10 cents per kw-hour, with a minimum rate of $1. The old rate in force before the present company took hold was 20 cents per kw-hour with discounts, many customers being still on the old rates.

The power station is located on a block of land adjoining the Santa Fe Railroad, on which block the gas works are also located. The station is equipped with alternating-current generaors, three-phase, 60-cycle, of Bullock manufacture. The current used for railway purposes is put through motor generators. Both lighting and railway loads are supplied from the same generator bus-bars. This is made possible by the use of a voltage regulator of the General Electric Company operating on the exciter, which maintains constant bus-bar pressure in spite of the variations in railway load.

There are some unusual features worthy of note in the lighting distribution system. The business part of the town is served by three-phase secondary 110-volt mains located in alleys. Outside of the business districts the distributing circuits are single-phase. Taking, for example, an alley back of one of the principal streets, the lines are led at different points with three large transformers, one on each phase. The only wires running the length of the alley are the secondary mains. The high-tension, 2,200-volt wires supplying these transformers are tapped off from a high-tension pole line, which runs on a residence street parallel with the alley. These taps off the high-tension pole line to supply the transformer are led down cross streets for the half block from the pole line to the transformer, which is located at the intersection of the alley and the cross street. The three-phase secondary mains cover a business district of about 3x5 city blocks.

## Getting New Central Station Business.

At the annual meeting of the Colorado Electric Light, Power & Railway Association, Mr. R. L. Goodale presented a paper entitled "Getting New Business," in which he treated of central station management from the business getting end.

In commencing he said there should be a systematic canvass of the commercial and residence districts, including every house that can be reached in any way by the company's lines. Information should be secured as to whether the houses are wired or have the fixtures, and all other information that may lead to securing new consumers, or if already consumers, selling them some additional current-using device. This information can be kept on cards filed in very inexpensive drawers or cabinets, and should be kept up to date.

For additional business one must look largely to current-using devices and appliances—that are new to the prospective consumer. The general field for work along this line may be divided for convenience into a few general heads, as follows:

1. Commercial power business, including large and small installations of motors for varied purposes.
2. Sign, window and decorative lighting.
3. Residence lighting and appliances.

As a general thing the start is often the most difficult part of introducing any special device, and is often the only time when a central station management need make any special concession to a consumer.

A consumer using other methods of power is often a little slow about adopting an electric motor in exchange for his old method, even if he is not getting the best results out of it and it is not entirely satisfactory to him. In nearly every town are small printing establishments operating small job presses by foot power, and the owners often can only be convinced in one way, and that is to install and make a demonstration with a motor. This is productive of good results, even if a motor is not sold every time one is installed. Often the first motor installed is the only thing necessary to open up a small or possibly a large field for the consumption of current. Any appliance installed and giving satisfaction is a better advertisement than any paid advertisement one can devise. There is another opening at blacksmith and carriage shops in motors for forge blowers. They are not expensive to run, and any blacksmith will appreciate the saving of labor. The motor-driven blower is a good wedge to start the blacksmith with, and if he is at all progressive it will be found easier to sell him motors to operate his drill press and other small power-using tools and machines.

In putting out special appliances of this kind it is well to deal with the more progressive man in a special line of work, for there will not be much difficulty in getting him to try an appliance, and he will be apt to try it, keep it, and not only that, but boost it for all there is in it.

The original cost, even if it is high, does not always stand in the way of the sale of an appliance. In certain cases a man in a well-established business will pay a big sum for an appliance, simply because it will bring him big results. A case in point is a barber in Colorado Springs who is very slow to take up with anything new. He was approached by a traveling man from a barber supply house who induced him to buy a facial massage machine. This machine cost him $125, paying for it on the installment plan, and it represents a pretty good outlay for a slow man to make on a new appliance. Now that he has it, it would be hard to induce him to part with it, and he says he gives an average of about ten treatments a day at 35 cents a treatment. The power for this number of treatments will not run more than 8 to 12 units a month, and so he thinks he has a good thing. This item is not a large amount in itself for the company, but it is one of the many ways that in the aggregate mean more business.

The subject of sign and window lighting opens up an immense field for the use of current, and if presented in the right way will take with almost any merchant. Provided a town has saloons, there is a good basis to start a sign campaign. The saloon men don't advertise much, if any at all, but the electric sign furnishes a method by which they can advertise and at a time when it will do them the most good and bring them the

most trade. Advertising offers a new field for the consumption of power, and if presented to the customer along absolutely advertising lines will be one of the easiest methods of getting new business. A consumer must not be allowed to believe that he is spending his money for lighting when you sell him a sign. Compare a sign costing him $15 a month to the amount of space that the same money will buy him in the papers and he will readily see that he has a cheap and most effective method of advertising.

The man who keeps open his place of business at night is not the only one to profit by a sign. The next man is the merchant who closes at, we will say, 6 o'clock. Why should he not keep his windows well lighted, as a pedestrian will look in at a well-lighted window at night when he will pass it by in the day time? Add to that an attractive sign, well lighted and hung across the sidewalk, and he will have something that will draw the people. His windows will show them what he has, and his window lighting, if properly arranged, will make his store appear so attractive that they will seek this place when they wish to make a purchase at some future time.

Sooner or later one will get up against the merchant who says he does not light up because there is no one on the streets; but he will know, if he stops to think of it, that the people will not walk on dark streets. It makes no difference whether the city is New York or a village, the people will walk up the well-lighted streets and "pass up" the dark ones. The merchants are the ones to make the start with. One of the ways is to light a sign for a certain number of hours per night, controlling the turning on and off by a patrolman or time switch, making a flat rate, and, if necessary, putting the sign on a weekly basis and sending a collector to collect the bill on Monday morning before the banks are open.

The general sign rate is about one-half the regular gross rates for current, and when the current is used in an entirely new field and in a new demand it is well worth getting at that price. There are many sign companies ready to make signs on their own or your designs, but one can build a sign, or have it done by local supply houses, cheaper than he can ship it in. The matter of sign design and construction will not take very much time for study, and the catalogues of the various manufacturers of signs will show what other cities are doing in the way of using electricity as an advertising medium.

Many central station managers, representing both large and small plants, who have taken time to analyze the value of sign advertising have come to the conclusion that it is a good thing to boost, and as the original cost of a sign often stands in the way of a merchant installing one, they have reached the conclusion that it is well worth the money spent to furnish free signs and make a two years' contract with the merchant.

How many line extensions will give you the return that the investment in a sign will bring? The sign that brings in $15 a month means $180 a year. The sign will cost not to exceed $60. It is worth hustling for, and is usually not so hard to land as a residential extension that will give you $60 income for a $180 line cost. Don't overlook your window lighting, but boost it along the lines of advertising and not lighting. A merchant will sometimes pay $100 a month for newspaper advertisements and kick at a $5 bill for lighting his windows, when his windows well lighted will bring him more business.

A good laundry iron of from five to six pounds can be bought now for from $4 up, and manufacturers are now working along the lines of heating units that can be renewed without sending the iron back to the factory. The laundry iron can be used for general laundry work in a residence, and a family of from two to four will only use from ten to fourteen units per month. They appeal at once to the men, as well as the women, as an economy, not an expense, and they will sell rapidly when they have once been properly introduced.

If you have a show room, you may find it rather difficult to get people to come and look at an iron; but just take the iron out on ironing day and install it, and tell the people that you want them to try it for thirty days. Explain to them the economies of an electric laundry iron, and at the end of the thirty days show them their bill, and unless it has gone up more than a couple of dollars you will find that you won't have 5 per cent of your irons returned. Sell them at cost and install them at cost, but get the irons in commission. They will be used the year 'round, and any single appliance that you can put out that will bring in from $18 to $24 worth of income a year is a good thing.

A certain central station in Colorado has sold a good many small motors for family washing machines, but has not sold an electric laundry iron. It would seem that you could sell more laundry irons at $5 than washing machine motors at $20 to $40, and the iron would bring in more income in a year. The sewing machine motor, however, has a field of usefulness to the consumer.

As to publicity, keep your business before the people as much as you can, and in as many ways as you can afford. Don't let your newspaper announcements get dead, but change them frequently. They may not be all of the best quality, but you will find that the contrast between the good and the poor will draw attention to them. If you want new business and more business you must give it as much publicity as you can. Business does not come to many of us; it is necessary for us to go out and get it.

## New Telephone Patents.

### NEW OPEN SPACE ARRESTER.

For a long time in telephone practice the standard material for the terminals of open space cut-outs has been rough ground carbon blocks. These have given continual trouble from the accumulation of carbon dust, but nevertheless the regularity of action and the freedom from welding has outweighed all other considerations. G. W. Pickard, of Amesbury, Mass., has advanced the theory that the carbon dust itself may be eliminated by impregnating carbons with a suitable adhesive substance to bind the particles tightly together. He has obtained patents covering this device which he has assigned to the American Telephone and Telegraph Company.

### TRANSMITTER ARM.

A patent has been granted to E. E. Yaxley, of Chicago, for a hollow transmitter arm designed to carry a particular style of transmitter. This transmitter carries a rearward stud which is integral with the transmitter casing, and which carries in its center an insulated terminal. The hollow arm has a split end with clamping screws so that the transmitter stud may be chucked within it. It also carries an insulated contact device which contacts, with spring pressure, with the insulated terminal within the stud. Mr. Yaxley's invention has been assigned to the American Electric Telephone Company.

### COMBINED MESSENGER AND TELEPHONE SYSTEM.

An improved combined messenger and telephone system has been invented by G. Babcock, of Chicago, wherein an ordinary messenger call box may be associated on the same line with a telephone, and either may be used at will. A printer at the central office receives the messenger call in the usual way, the arrival of the call being indicated to the operator by a flashing line lamp. For a telephone call a steady burning of the lamp occurs. The differentiation between signals is controlled by limit relays, which respond or fail according to the resistance in circuit at the subscriber's station.

### PARTY LINE APPARATUS.

G. H. Manners has patented the use of a push-button switch for party line telephones, which connects the signal devices either in metallic or grounded relation to the line. In the one instance the exchange becomes signalled to the exclusion of the stations, and in the other the stations are signalled to the exclusion of the exchange.

E. A. Buell has patented a step-by-step system by which in the case of a call toward a line all stations save those called are excluded from the line. In the case of a call originating from a line, the exchange operator may seek for interlopers by testing for their respective stations. It is not quite evident why this

testing does not effectually bar conversation while it is proceeding.

An arrangement of relays suitable for the foundation of a party-line system has been patented by W. M. Bruce, Jr., of Springfield, Ohio. The relays are arranged, one off each side of the line to ground, the circuit of each being carried through the contact points of the other, so that either will respond to currents on its own side of the line, while one only responds to currents on both sides.

# LETTERS TO THE EDITORS.

## Starting Rotary Converters.

*To the Editors of Electrical World:*

SIRS: That part of the editorial in your issue of December 23d on "Converter Substations" which refers to the methods of starting synchronous converters, evidently favors starting from the direct-current ends. While this method (as your editorial points out) gives considerable precision in speed control during the period of synchronizing, yet it presupposes the presence of either a starting set composed of an induction motor and a direct-current generator or a storage battery.

If the former method is used, it means the introduction of a relatively costly auxiliary as a part of the substation equipment, and, in any case of starting from the direct-current end, it necessitates added complexity to the switchboard equipment, such as field-changing switches and relays for freeing the direct-current end from the starting source, when the alternating-current end is connected with the source of supply.

The scheme of throwing the alternating-current end directly on the alternating-current supply at reduced voltage, is somewhat simpler than the above method, but has the disadvantage of seriously disturbing the system, owing to the heavy magnetizing and therefore lagging currents drawn by the rotary armature under these conditions. The use of this method also reduces the usual simplicity of the shunt-field wiring—it being necessary to have the coils so wired to a multiple point switch, that the individual bobbins may be disconnected from each other to avoid the heavy induced voltage that would result, were this precaution not observed. This method has the one advantage, however, that the rotary is, so to speak, automatically synchronized, it only being necessary to apply full voltage after the proper speed has been reached.

The method which seems preferable to those cited above, is the one employing a starting induction motor, the rotor of which is mounted on an extension of the rotary armature shaft. This motor should be of a type having a relatively high secondary resistance, and therefore possessing the property of having a high starting torque per ampere, with a corresponding reduction in the disturbance created on the system when starting. It should also have a fewer number of poles than the rotary (usually one pair less than the latter) in order that the speed of the starting motor, including the slip, will just nicely bring the rotary to synchronous speed at normal voltage.

Good results are obtained by this arrangement when the capacity of a motor of this type bears the proper relation to the total no-load rotary losses at normal speed and voltage when synchronizing with the low-tension side of the lowering transformers, and to the total no-load rotary losses at normal speed and voltage plus the iron loss in the lowering transformers at normal voltage, when synchronizing with the high-tension bus bars Under these conditions the starting motor takes the rotary above synchronous speed on weak field charge, and as the latter is increased the speed falls, the operator having ample time to throw in his machine when passing gradually through synchronism.

This method, although it does not permit of such refinement in speed control as with the direct-current starting, serves well the intended purpose, and has the paramount advantage of simplicity—a rare jewel in modern substation design.

TORONTO, CANADA. CLARENCE P. FOWLER.

## Efficiency of Lighting Balancers.

*To the Editors of Electrical World:*

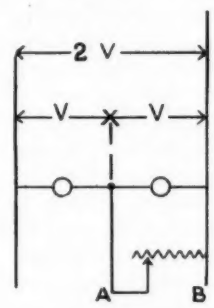
SIRS: Referring to Mr. Budd Frankenfield's interesting article on "Regulation and Compounding of Lighting Balancers" in your issue of December 23d, I note that on page 1067 the writer states that "balancer efficiency $= eg \times em$," where $eg$ is the generator efficiency and $em$ the motor efficiency. The good regulation obtained by a balancer set would have a serious counter consideration if the efficiency of a balancer set were as low as here stated. The over-all efficiency of a balancer set is considerably higher than the product of the efficiency of the two units composing it. This may be shown as follows, referring to the accompanying sketch:

$$\text{Efficiency of this apparatus} = \frac{\text{output of set}}{\text{input of set.}}$$

$$= \frac{\text{Watts wasted in resistance "A B"}}{\text{Watts supplied by mains.}}$$

$$= \frac{V\ (\text{gen. current} + \text{motor current.})}{2V\ (\text{motor current.})}$$

the motor current being main line current at $2V$ volts. Using




BALANCER DIAGRAM.

Mr. Frankenfield's symbols, the several currents being distinguished by subscripts, we have

$$\text{Efficiency} = \frac{V(Ig + Im)}{2V\,Im}$$

$$= \frac{1}{2} + \frac{Ig}{2Im}$$

The efficiency as motor-generator set is, assuming the voltage balanced,

$$= Eg \times Em = \frac{Ig}{Im}.$$

On page 1068 Mr. Frankenfield gives an actual example and obtains a combined armature efficiency of 55.6 per cent. What is meant by combined armature efficiency is not stated, but it is apparently the same thing as the efficiency as a motor generator set when "motor voltage = generator voltage."

The efficiency as a balancer set is as follows:

$$\text{Efficiency} = \frac{1}{2} + \frac{Ia}{2Im}$$

$$= .5 + .278 = 77.8 \text{ per cent.}$$

This value, it will be noted, is very close to the efficiency of each unit of the set when run as motor generator.

The whole problem of balance on three-wire or multi-wire systems, and the amount of energy actually transmitted from one part of an unbalanced system to another in the attempt to obtain electrical equilibrium, is of great interest and one on which the writer at least, and doubtless many other readers, would be glad to hear from Mr. Frankenfield again.

SCHENECTADY, N. Y. C. T. WILKINSON.

# DIGEST OF CURRENT ELECTRICAL LITERATURE

## Dynamos, Motors and Transformers

*Induction Motor.*—Brunswick.—An illustrated article on the Boucherot induction motor which has, as is shown in Fig. 1,

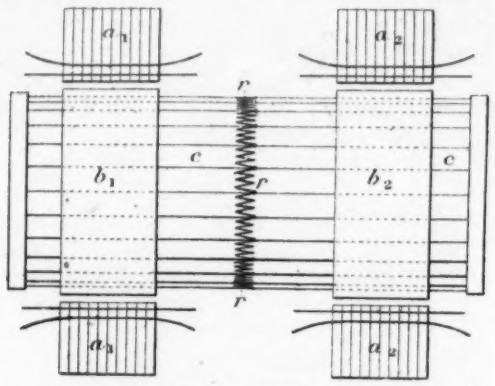



FIG. 1.—DIAGRAM OF INDUCTION MOTOR.

two stators, $a_1$ $a_2$, and a common squirrel-cage armature, $b_1$ $b_2$, in the middle point of which are inserted resistances, $r$. These resistances are active only when the e.m.f's. in the two stators are not in phase. The value of these resistances is so chosen as to yield the desired starting torque. At starting there is an artificial phase difference between the two stators which is gradually removed when the motor runs up to full speed. The phase difference is produced in one type of the Boucherot motor by mechanically displacing one stator. But this construction is possible only when the motor is easily accessible. For other purposes the phase difference is produced by electrical means and an arrangement is described which is used mainly for motors driving centrifugal pumps and large ventilators. Fig. 2, indicates the connections as they follow each other from starting to full speed. The lowest diagram in Fig. 2 shows the connections in the moment of starting. Each stator is star connected, but the windings of the two stators are opposite to each other. The middle diagram shows the connections shortly after starting. Here only one stator is active, the other is short-circuited. With these connections the resistances, $r$, in Fig. 1, are rendered less effective. The diagram at the top in Fig. 2 shows the connections at regular running, the two stators being in phase.—*L'Industrie Elec.*, December 10.

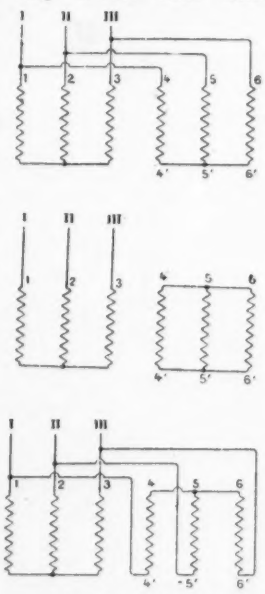



FIG. 2.—DIAGRAM OF CONNECTIONS.

*Liege Exposition.*—Reyval.—An illustrated description of several electric machines exhibited by the Allgemeine Elektricitäts Gesellschaft-Union Company. Detailed drawings and dimensions are given of a 210-kw, steam-driven, direct-current dynamo supplying directly a three-wire system with 500 volts between the outers by the Dobrowolski system.—*L'Eclairage Elec.*, December 9. A steam-driven, 60-kw, 440-volt, direct-current Jaspar dynamo, running at 725 r.p.m., is described in detail in *L'Eclairage Elec.*, December 16.

## Lights and Lighting.

*Miners' Lamps.*—Schmerber.—An account of practical tests of modern miners' safety lamps at the official testing station in Belgium.—From *Le Genie Civil;* in *Eng'ing Mag.*, January.

## Power.

*Mechanical Coal-Handling Plant and Boiler House Economy.*—An article giving examples which show the effect of a mechanical coal-conveying plant on boiler house economy. The installation of the Coventry municipal station is first described. The fuel for the six boilers is brought to the works by a canal adjacent to the boiler house, thence in the old days of manual labor it was raised by hand and wheeled into a space in front of the boilers. Now mechanical apparatus, driven by electric motors has been installed for barge unloading, conveying, storing, elevating, distributing and stoking. The mechanical stokers are of the Bennis type, with pneumatic gear and self-cleaning compressed-air furnaces, and are specially adapted for burning a low-grade fine slack. By the recent addition of the compressed-air bar, into which the air is forced by the aid of a minute steam blast in each bar, to the Bennis system of stoking, a combination of the chief benefits of mechanical firing with forced draught is obtained. By a regulation of the steam blast the quantity of steam raised can be increased or decreased as required. A comparison of costs between the old system and the new shows that considerably over 60 per cent is saved in the course of transit from barge to boiler. As another example, is given the coal handling plant of the City Road station of a London company. Here an hydraulic crane with a nominal lifting capacity of 2 tons removes the coal from the barges on the Regent's canal by means of a 15-cwt grab, and raises it to a hopper on the roof of the coal store. Sixty tons of coal are raised in 2½ hours by this means. The entire work is conducted under the superintendence of two men with the assistance of a boy who acts as trimmer.—Lond. *Elec.*, December 15.

*Cranes Driven by Single-Phase Motors.*—An illustrated description of an installation of wharf-cranes in Cologne, Germany, driven by single-phase alternating-current. The frequency is 50. The voltage for the cranes is transformed from 2,100 down to 500 volts. The 40-hp lifting motor is an induction motor of 10 poles. Armature and collector resemble those of a continuous-current motor. There are ten sets of carbon brushes, "two of which serve for the induction of a separate current, which, being out of phase with the main current, produces a rotating field." The motor runs as a two-phase motor at starting. The auxiliary current is interrupted as soon as full speed has been reached. "The speed variation of the motor is secured by changing the primary voltage impressed on the motor by means of transformers which perform the service of controller resistances." The operating mechanism for each motor consists of controller and transformer.—Lond. *Eng'ing*, December 22.

*Electrically-Driven Air Pump.*—Corsefius.—An illustrated article on an air pump in a German electric station, driven by a single-phase motor without commutator. The same is of the author's design which has been mentioned before in the Digest. Although it has no commutator, it starts under load. The principle of the motor is the application of the Arno phase splitter. The motor has two rotors, one of which is loosely mounted on the axle and is started unloaded by some well-known method. This auxiliary rotor produces an armature reaction and the main rotor is then started as in a two-phase motor. Characteristic curves of the motor are given.—*Elec. Bahnen*, November 24.

*Low-Grade Fuels.*—Goodrich.—A second article on the utilization of low-grade fuels for steam generation. The author deals especially with the adaptation of the boiler furnace and other appliances to the burning of low-grade combustibles. He shows that many low-grade and cheap fuels are well worth burning for steam generation if properly handled. A really first-class fireman, not a mere thrower-in of fuel, is a valuable servant. The average fireman, however, prefers expensive fuel because it requires the minimum of exertion on his part.—*Eng'ing Mag.*, January.

*Power Chart.*—Carle.—A chart for finding the power of an engine and showing the relation between the cylinder dimensions, point of cut-off, initial pressure, speed and horse-power. The application of the chart is described.—*Power*, January.

*Storing Energy.*—HERZOG.—The first part of an illustrated description of the Olten-Aarburg electric station in Switzerland in which the power developed during the night is stored and thus made available for use during the hours of maximum load. For this storing purpose, centrifugal pumps have been installed, which during the night hours raise water to a reservoir on top of a mountain near the station.—*Zeit. f. Elek.* (Vienna), December 17.

## TRACTION.

*Alternating-Current vs. Direct-Current Railways.*—LAMME.—A long article on the relative advantages of direct-current and alternating-current for heavy railway service. The present direct-current traction system has accomplished wonderful results. There are, however, limits to its application, the most important of which is the low voltage which has been used heretofore. About 15 years ago, 500 volts was the usual pressure, while at the present time 650 volts is rarely exceeded in regular service. While there has been good reason for years for going much higher, it is evident that something more than mere adherence to a standard has prevented the use of higher direct voltages. The difficulties in designing direct-current railway apparatus for higher voltages are due not to lack of ability to construct a railway motor which can be wound for 1,500 volts, but largely to certain operating conditions found principally in railway service. The questions of high-voltage control systems, high-voltage rotary converters, or motor-generators, as well as high voltage on the motors themselves must be considered. Experience tends to show that when the voltage across the motors is raised to 1,500, the difficulties due to flashing would practically prohibit their use if the present types of construction are retained. There are certain ways in which this flashing tendency in high-voltage motors could be suppressed, but these involve very radical changes in the design. For example, they could be made entirely with laminated magnetic circuits with no closed secondary paths and no low resistance secondary circuits in the armature winding. The field would be provided with neutralizing or so-called "compensating" windings, which practically neutralize the magnetizing effect of the armature. This ideal type of direct-current motor is, however, the one which has been developed for use with alternating current, and such a motor, with relatively small expense, could be designed to make a rather good machine for operating directly on alternating-current circuits of low frequency. In discussing the use of high-voltage direct-current generators, the author states that a 1,500-volt direct-current generator may represent a permissible design, but a high-voltage rotary converter presents some problems which are not found to the same extent in the present low-voltage machines. Experience has shown that the possibility of flashing increases rapidly with increase in voltage. With a voltage of 1,500 on rotary converters, the flashing tendency would be enormously increased, and might even prohibit the use of this class of machinery. In regard to high-voltage direct-current generators, it may be stated that the design of a first-class direct-current, 1,500-volt railway generator with one terminal grounded presents such possibilities for trouble that those designers most able to construct such a machine are the ones who would raise the greatest objection to doing so. The true merit of the single-phase system lies not in any inherent superiority of the motor itself, but in the fact that any desired voltage may be used on the trolley system, while the voltage delivered to the motor system can be varied economically. The alternating-current commutator type motor is necessarily built along lines which would make a very superior direct-current type of machine, and, therefore, in comparing the alternating-current motor with the direct-current motor, it is only fair to compare it with what could be obtained from the same material and construction properly applied in a direct-current machine. Under such condition the direct-current motor will undoubtedly show extremely good characteristics. In fact, certain types of single-phase alternating-current motors now in the market are in reality very fine direct-current machines, and will operate on direct current in many ways more perfectly than any purely direct-current motor now on the market. It has been a question with the manufacturers, whether, instead of going to the refinements necessary to obtain a limited increase in voltage on direct current, with the accompanying high-voltage control, high-voltage direct-current generating plants, etc., it would not be advisable at once to wind the motor for alternating current, and thus open the way for the use of much higher voltages and at the same time obtain a low-voltage control system which is of the most efficient known type, namely, variable e.m.f. from transformers. On account of the comparative newness of the system, the question has been raised from time to time whether single-phase alternating motors of suitable size and capacity can be built for heavy railway service. But as such motors have been built and given severe tests, and are being built in comparatively large quantities, and as those manufacturers with experience in the design of such machinery state positively that they can build such motors, there should be no further question on this point. The question seems to be turning now to the comparative economy of the single-phase system and the direct-current system with rotary-converter sub-stations. As a rule it has been found that the total first cost of the single-phase system is considerably lower than that of the standard rotary-converter system, the difference depending upon individual conditions. Not considering the power house, in some instances this difference may amount to as much as 30 per cent, while in others it may be as little as 10 per cent. In any condition where the direct-current system requires any considerable use of the rheostat for regulating the speed, the single-phase syster has the advantage in economy of operation as far as the equipment itself is concerned. But under conditions where the direct-current equipment does not require a rheostat, the advantage is in its favor. Such conditions, however, would be the exception rather than the rule, in service corresponding to that of the present steam roads.—*St. R'y Jour.*, January 6.

*Single-Phase Locomotive.*—On the Swedish railways experiments are being made at present with single-phase alternating current of 25 periods per second. These tests are made with a view of introducing later on single-phase traction in general on the Swedish railways, since Sweden is rich in water power but not in fuel. Two locomotives and two motor-cars have been ordered partly from the Allg. Elek. Ges. and the Siemens-Shuckert Works in Berlin and partly from the British Westinghouse Company. Single-phase commutator motors are used throughout. In the present article the locomotive furnished by the Siemens-Schuckert Works is described. It has a weight of 36 tons and is intended for freight trains with speeds up to 45 km. per hour on a level road and about 24 km. per hour on grades of one per cent. By changing the ratio of gearing it is intended to increase the speed later on to 65 km. per hour. The locomotive has three driving axles, each being driven by a compensated series motor of a design similar to that of those used on the Murnau-Oberammergau single-phase road. The normal capacity of the 320-volt, 25-period motors is 110 hp, and with the ratio of gearing of one to five, which is used at present, the maximum tractive effort of the three motors is 6,000 kg. at the wheels. In the front of the locomotive a transformer is placed with a normal capacity of 300 kilovolt-amperes, the primary of which consists of a series of windings the connections of which may be changed so that the voltage supplied to the primary may be varied between 5,000 and 20,000 volts. One of the chief purposes of the tests is to find the highest voltage with which a safe and satisfactory traction service can be maintained. The voltage of the secondary of the transformer can be varied between 160 and 320 volts. The controller contains 10 positions, the first one of which is intended for very slow speed, and a special device for blowing out magnetically the spark due to the short-circuiting of coils. The motors are artificially cooled with air. The locomotive has two aluminum bows for taking off the current from the trolley wire.—*Elek. Anz.*, December 17.

*Single-Phase Motor Car.*—DIETL.—A very full and profusely illustrated description of the first motor car completed for the single-phase railway from Blankenese to Ohlsdorf, near Hamburg. The car has six axles and is really a double car, only one-half of it taking current from the trolley wire. The length of the whole car is 29.55 meters, the total weight without passengers 71 tons. A single-phase current of 6,000 volts and a frequency of 25 will be used, the voltage not to increase beyond 6,800 and not to fall below 5,200. The rails will be used for the return current. The motor car is driven by three Winter-

Eichberg motors of the same type as used on the Niederschoenweide-Spindlersfeld road, the only new features being stronger construction and ventilation. On the commutator side of the motor, fresh air is sucked in through the hollow axle and is passed through the motor in such a way that neither the windings, the commutator nor the brushes come in direct contact with it. The equipment is described in detail and illustrated by diagrams.—*Elek. Bahnen,* December 4.

*Indian Tramway.*—An illustrated description of the electric railways of the city of Singapore, which has a population of 250,000. The total length of the roads is 16 miles of route, the length of the single track being about 26 miles 4 furlongs. The track is laid to a gauge of 1 metre, with rails of the girder type weighing 95 lb. per yard. The rail joints are welded by the thermit process, so that the track forms one continuous length, and in addition, a 6-0 S.W.G. copper bond is supplied at every joint, ensuring perfect electrical conductivity. The trolley wires, which are not necessarily over the center of the track, the possible variation being about 10 ft., are divided into ½-mile sections by means of section insulators. There are two main engines in the power house each of 927 hp, which may be worked either condensing or non-condensing. They drive 500-kw, 500-volt direct-current generators running at 100 r.p.m. The lighting sets consist of one 150-kw generator and a 50-kw motor-generator. Two balancers are also installed.—Lond. *Elec.,* December 15.

*British Tramway.*—An illustrated description of the Falkirk tramway in Scotland. The complete length is 7 miles. For transmission 4,300-volt, two-phase currents at 50 periods are used. The sub-station is equipped with two "Peebles-LaCour motor converters" and with negative boosters. There is no storage battery.—Lond. *Elec. Rev.,* December 22.

*Steel for Third Rails.*—Wales.—An account of experiments on the electrical conductivity of steel as affected by chemical composition and physical treatment. The best obtainable results by use of steel rails of standard composition, show a resistance of between 10 and 11 times copper of the same section with direct-current, while values of resistance as high as 70 times copper have been obtained in some experiments with alternating current at 40 cycles. The best iron third rail material in use to-day as to electric conductivity is that used by the London Underground Railway which has the following composition: Carbon, .05; manganese, .19; phosphorus, .054; sulphur, .03; or a total contained elements not iron, of .373; its electric resistance is 6.4 times that of copper of the same section. From the tests made by the author the following general conclusions may be drawn: The resistance increases with the total amount of dissolved impurities, or what is known as the "total content not iron." Of all the common impurities found in steel, *Mn* has the most powerful effect in increasing the resistance. Annealing and tempering of the very soft specimens is of practically no value. The effect of the water hardening on the resistance of the higher-carbon samples is quite marked, but the annealing appears to return the steel to its former condition electrically, and nearly so physically.—*Rose Technic,* December.

*Supervision of Motormen.*—An article stating that a proper supervision of motormen should be based on the ratio of the time of running with current to the total running time. The smaller this ratio, the more efficient the motormen. For this purpose a watch may be used which gives only the time during which current was consumed. The essential part of it is an electromagnet which, when the car runs with current, attracts an armature and starts the watch.—*Elek. Bahnen,* November 24.

*Regenerative Control.*—Feldmann.—An article illustrated by diagrams on the regenerative control system of Johnson-Lundell which has already been noticed in the Digest.—*Elek. Bahnen,* November 24.

*Street Railway Apparatus.*—Rakestraw.—An article of a general nature on the erection and operation of street railway apparatus.—*Sibley Jour.,* November.

### Installations, Systems and Appliances.

*Protection of Alternating-Current Circuits.*—An illustrated article on inductive-balance devices for the protection of alternating-current circuits. The application of the principle of the maintenance of an inductive balance between two oppositely-wound sections of a transformer or reactance coil presents many advantages over other systems for the operation of the relays and protective devices employed in the control of high-tension switchgear, especially in cases where "discriminating" devices are required. The author first describes an inductive balance relay as applied to generator circuits and shown in Fig. 3. A potential supply from the bus-bars is connected to the center of the secondary winding, *XY*, of a small series transformer. As this winding is wound entirely in one direction, and as there are an equal number of turns on each side of the point of potential connection, the current from the bus-bars will be divided equally between the two halves, and these currents will have an equal and opposite magnetizing effect upon the core of the transformer. A perfect inductive balance is by this means established. The outer connection of the secondary winding referred to are connected to two solenoids, *A* and *B,* and so long as the current in these solenoids is equal, the magnetic pull on the swinging armature will be equal and opposite. This armature is, however, normally held in the position shown by a small adjustable weight. The main current flowing from the generator into the bus-bars will induce a secondary current in the local circuit, *X, A, B, Y,* in the direction indicated by the full arrows, and this will so disturb the inductive balance as to cause a greater current to flow through the branch, *X, A,* than through the branch, *Y, B,* with the result that the pull due to gravity, tending to hold the relay in the open position shown, will be supplemented by a magnetic pull approximately proportional to the amount of current flowing from the generator to the bus-bars. Should the generator break down, current will tend to flow from the bus-bars into the generator, thus reversing the direction of the current through the series winding relatively to the direction of the current due to the potential supply. The series current will now induce a secondary current in the opposite direction to the full arrows around the local circuit, *Y, B, A, X,* and as this will cause more of the potential currents to flow through the side, *Y, B,* than through *X, A,* the magnetic pull in the solenoid, *B,* will overcome the pull of *A* and will cause the armature, *C,* to move into such a position as to close the local circuit through the tripping coils, operating the main circuit breaker. There are examples of the same principle here described and illustrated.—Lond. *Elec.,* December 15.

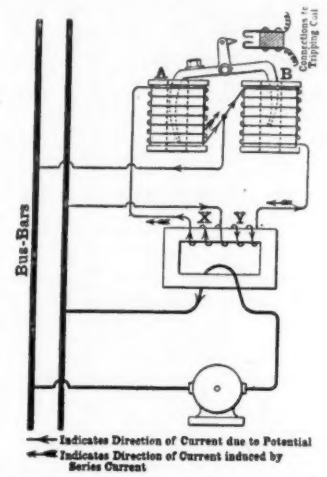



FIG. 3.—PROTECTING ALTERNATING-CURRENT CIRCUITS.

*Municipal Trading.*—Swinburne.—In an address on efficiencies (abstracted separately in the Digest) the author makes some pointed remarks on municipal trading and municipal electric supply undertakings. "If a station is run by a town, the accounts must be kept by an absurd system." Towns are generally concerned with such things as sewage systems, in which there is no profit and loss account. To build a sewage system the town borrows money and pays it off in a number of years out of taxes. "The town, therefore, does not save money like the private individual and then buy what it can afford. I do not think it would be allowed to do such a rational thing; it has to borrow money for everything and pay it back over a term of years.

The length of the term has no reference whatever to the nature of the work done, as the work is not in any way security for the loan, the local rates are the security. There is an epidemic of outcry just now about municipal indebtedness, but it is apt to give a totally wrong impression to the average reader, as he does not realize that the municipalities must be in debt owing to the way these things are arranged. For a private individual always to be in debt would be bad; for a town it is another matter; the only question is how much the town ought to be in debt." But local authorities are now taking up such businesses as electric supply and tramways, which have profit and loss sides; but they are obliged to work the business on the same lines as town improvements, "which is absurd. A municipal electric light scheme is thus worked under absurd difficulties. It is like a public company that has a negative capital; that is to say, all its money is borrowed. The shareholders are the taxpayers. They hold shares depending on the tax assessments. The dividends are generally negative. All the shareholders are so by compulsion if they live in the place. The only thing they can do if they do not want to be shareholders in such undertakings is to move off to another town; but then they become shareholders in another set of ventures. I believe the only way to avoid being shareholders in these compulsory undertakings is to live in a barge on a canal. Be this as it may, the undertaking, though a profit and loss concern, must keep its accounts on the same principle as if it were a sewage system. To begin with, the town may only borrow enough money to put down the plant. This has to be paid off by the sinking fund, which returns all the borrowed money, in say, 20 years. The plant may last ten years, or it may last 50 years, that has nothing to do with the case." A private concern would start business with enough capital to put down the station, and to run it at a loss for a year or two until it turned the corner. The municipality may not do anything as sensible as that; it may only borrow money enough to put down the station, and the first few years losses must be paid for out of the taxes for these years. This sometimes excites the taxpayers. Almost any business has to be run at a loss at first, and enough capital must be provided to meet the deficit, and when the business pays it ought to pay on the whole capital. No one would think of starting, say a factory with no working capital at all, and distributing a negative dividend during the next few years to pay the losses. This is one of the many absurd conditions under which municipal work has to suffer." In one case a lovingly solicitous gas company felt that it was hard that a municipality should lose during the first years, so it got a clause inserted to the effect that if there were a loss the price should be raised and raised until there was either no loss or no customers; it did not matter which, though in its heart of hearts the gas company preferred the latter. This clause was solemnly inserted in one or two acts by the collective wisdom of the country. It may interest you to realize that the large commercial interests of this country are controlled by a set of people who think that if a manufacture does not pay the simple expedient of raising the price will put things right."—Lond. *Elec.*, December 1.

*Electric Installation in the West Indies.*—MOSES.—A description of an electric power plant in a West India island for supplying power for irrigation, for a sugar mill and for lighting purposes. For irrigation, rotary pumps are used, operated by three-phase motors, the voltage of transmission being 6,600. For lighting the district a three-wire alternating current system at 240 volts is used. For power purposes and for lighting the sugar mill a 120-volt direct-current system is used.—*Eng'ing Mag.*, January.

*Paris.*—A reprint of an official report of the Prefet de la Seine concerning projects of the future electricity supply in Paris. No definite conclusion has yet been reached.—*L'Industrie Elec.*, December 10.

## WIRES, WIRING AND CONDUITS.

*Feeders and Cables.*—RHODES AND WATSON.—Two papers read before the Manchester section of the (British) Inst. Elec. Engs. The paper of Rhodes gives mathematical formulas for the calculation of electric feeders and deals with the following problems: To find the cross-sectional area of a uniform circular cylindrical feeder of given length to carry a maximum current with a given fall of potential; to find the fall of potential along any portion of an electric feeder in which the current varies as in the foregoing problem; to find the fall of potential along a conical feeder in which the current is proportional to the distance measured from the end furthest from the generating station, having given the maximum current and the specific resistance of the material. Finally the author shows how to calculate the watts lost in the feeders under the different conditions. The paper of Watson is a discussion of the comparative advantages of the different methods of street cable systems giving comparative figures for the cost of installation under British conditions. "The most encouraging direction for improvement appears to lie in the use of a mechanically strong insulating and absolutely water-tight duct or trough, so that bare copper rod or tape can be used, surrounded with a suitable filling. The expense of stranding conductor and of cable insulation, which is at present considerable, will then be saved. The materials at present on the market most suitable for the purpose suggested are the asphalt trough and the patent fibrous material used for the construction of pipes for drawing-in purposes."—Lond. *Elec. Rev.*, December 22.

## ELECTROPHYSICS AND MAGNETISM.

*Roentgen Rays.*—BUMSTEAD.—An illustrated article on the heating effects, produced by Roentgen rays in different metals, and their relation to the question of changes in the atom. The author's experiments indicate that when Roentgen rays are equally absorbed in lead and in zinc, approximately twice as much heat is generated in the lead as in the zinc. It does not appear possible to attribute this result to errors in the measurements or in the theory underlying the experimental method. To account for this effect the writer has been able to think of only one hypothesis which is not in more or less direct conflict with experimental facts. This hypothesis is that, by means of Roentgen rays, the atoms of certain elements may be artificially broken up and that the energy thus liberated forms a part (and perhaps the greater part) of the energy which appears when the rays are absorbed by matter.—*Am. Jour. of Science*, January.

*Magnetic Alloys from Non-Magnetic Metals.*—GUILLAUME.—Some notes on the theory of the Heusler magnetic alloy made from non-magnetic metals, manganese, aluminum and copper. The explanation of the author is based essentially on the supposition that manganese and chromium, which belong chemically to the same class as iron, nickel and cobalt, are essentially magnetic metals, but have a very low "transformation temperature." In the alloys the transformation temperature is raised.—*L'Industrie Elec.*, December 10.

*Mechanism of Electric Current.*—LANGEVIN.—The first part of a summary of recent researches on the mechanism of the electric current and on ionic and electronic theories.—*L'Eclairage Elec.*, December 9.

## ELECTROCHEMISTRY AND BATTERIES.

*Measuring Speed and Acceleration.*—OWENS.—Some notes on a method described by the author in a former paper on measuring both the speed and acceleration of a revolving machine. Fig. 4 shows the arrangement. *S* is the revolving machine to

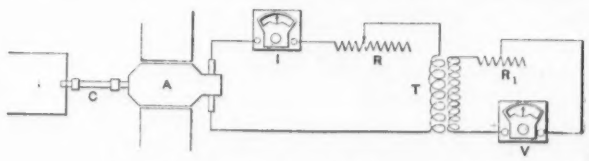



FIG. 4.—DIAGRAM OF CONNECTIONS.

be tested. Its shaft is mechanically coupled with the armature, *A*, of a small magneto-generator or constantly excited direct-current dynamo wound so as to have a negligible reaction within the limits of its use. *R* is a variable non-inductive resistance and *I* is a zero center direct-current ammeter. The reading of *I* will be proportional to the speed of *S* and, by adjusting *R*, can be calibrated in revolutions per minute, feet per second, or miles per hour, as desired. As the current through *I* is proportional to the speed, it is only necessary to determine the rate at which

the current varies in order to have a measure of acceleration. This is done by inserting in the circuit with $I$ a transformer, $T$, with its secondary connected, for purposes of adjustment, through a non-inductive resistance, $R_1$, to a zero center direct-current voltmeter, $V$. The reading of the voltmeter, $V$, will then be proportional to the acceleration, positive or negative, of the shaft, $S$. The transformer must have a straight line saturation curve and a large transformation ratio as the secondary induced voltage is necessarily small, and the voltmeter, $V$, must be sensitive.—*Machinery*, January.

*Meter.*—An official report of the Reichsanstalt concerning alternating-current induction meters, made by the Siemens-Schuckert Company and admitted by the Reichsanstalt for calibration. The instrument consists of an induction motor, braked magnetically and connected with a counting device. The movable part is a metal disc, the stationary part a three-leg iron core having the main current winding on the two side legs and the shunt winding on the middle leg. The construction is described and illustrated in detail.—*Elek. Zeit.*, December 14.

*Testing.*—Rowe.—A continuation of his illustrated serial on alternating-current laboratory testing. In the present installment he deals with the exciting current load losses, efficiency losses, polarity, test regulation, heat test and pumping back method. —*Jour. of Electricity, Power and Gas*, December. An illustrated article by Foote on commercial testing of electrical machinery by the loading-back method is found in the *Sibley Jour.*, October.

*Definitions of Electrical Terms.*—Emde.—A highly mathematical article giving exact definitions of electric tension, tension difference, potential, potential difference and e.m.f. For instance, "tension is the line integral of the electric field strength," etc.—*Zeit. f. Elek.* (Vienna), December 10.

### Telegraphy, Telephony and Signals.

*Transmitting Pictures.*—Korn.—An illustrated article on his method of transmitting photographs, handwritings, etc., over electric wires. He states that by his latest improvements he is able to transmit within 10 to 20 minutes portraits of the size of 13 by 18 centimeters over lines which have a resistance of 12,000 ohms. The transmitter is shown in Fig. 5. The photograph to

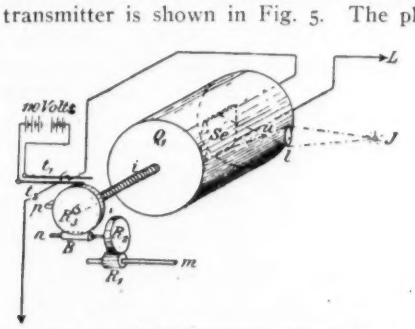



FIG. 5.—TRANSMITTING PICTURES.

be transmitted is placed in form of a transparent film on a glass cylinder, $Q_1$, and the light of a lamp, $J$, is concentrated through a lens, 1, upon a point of the surface of the film. The light rays fall upon a selenium cell, $Se$, through which an electric current is sent from a storage battery of 110 volts to the line connected with the receiver. The more transparent the point of the film through which the light passes at the moment, the greater is the current which is transmitted from the sender to the receiver. The glass cylinder revolves and by means of a screw it is arranged that with each revolution it passes forward (in direction of the axis) by, say, one mm. In this way each point of the photograph to be transmitted is gradually brought between the lamp and the selenium cell. At the receiving station the author uses vacuum tubes of a length of a few centimeters and a diameter of one cm., almost completely covered with black paper and having one small window (1/16th sq. mm.) from which the light of the tube falls upon the sensitive paper of the receiver. The receiving sensitive film is also wound around a cylinder revolving synchronously with the transmitting cylinder. The arrangements for producing synchronism and for causing the light of the vacuum tube to change with the current transmitted over the line are described in detail and illustrated. The author finally makes some remarks on seeing at a distance. For this purpose it would be necessary to reduce the time of transmission of a picture from 10 minutes to about 1/5th second.—*Elek. Zeit.*, December 14.

### Miscellaneous.

*Efficiencies.*—Swinburne.—An address to the students of the Manchester local section of the (Brit.) Inst. of Elec. Engs. The term "efficiency" is used to denote the rate of useful part of the energy or power obtained, to the energy or power put in. The term efficiency may also be stretched to cover questions of money, although "in the case of a well conducted bargain, each of the parties, to use a legal word, gives what he prefers to part with for what he wants more; so that both are satisfied." A trader who looks upon buying at $3 and selling at $4 as making a profit of 33 per cent "really deceives himself, because in such cases it is not really a question of how much is made over and above the apparent purchase price, but of what profit is made per annum on his trade capital." "In making any bargains with nature, we always lose in a sense; and we are so accustomed to it that we take it quite contentedly, and merely try to lose as little as possible in the transaction. The relation of what we do not lose to the whole is termed the efficiency." The author includes into the term of heat not only sensible heat, but also latent heat and chemical energy. He thinks "it is not realized that chemical energy is necessarily low-grade energy, only partially convertible into work." He introduces the idea of chemical temperature. For instance, the chemical temperature of carbon and oxygen is given as of the order of 3,000° C. or more, and it is defined by the statement that above this temperature the reaction goes on in such a direction that the oxide of carbon dissociates into carbon and oxygen, absorbing sensible heat, while below the chemical temperature the reaction goes on in the opposite direction, carbon and oxygen combining and giving out sensible heat. At the chemical temperature therefore, "under the pressure and quantitative relations of the carbon, oxygen, and carbon monoxide, sensible heat and chemical energy are interchangeable." If the burning coal, containing, of course, other constituents, such as hydrocarbons with other chemical temperatures, could hand over its heat at 3,000° C., nearly all of it would be available. As the heat is finally rejected at condenser temperature of 100° or so (3,000 — 100) ÷ 3,000, or about 97 per cent of it would be available. But we cannot run a boiler and engine between 3,000 and 4,000° C. In practice the boiler takes the heat up at less than 500° C., so that 5/6 is degraded or rendered unavailable right off. The real loss is between the fuel and the boiler and it is not loss of energy but loss of availability. The author gives a diagram (Fig. 6) illustrating the

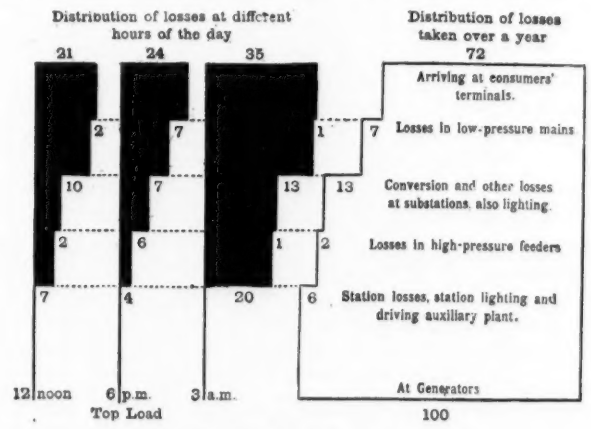



FIG. 6.—EFFICIENCY DIAGRAMS.

losses of the Metropolitan system supplying several London areas. The losses given on the right of the diagram are the averages for the year. Since they alter from time to time, the wastes are shown black to the left of the diagram for three representative times. The author then discusses municipal trading. He finally speaks of the comparative costs of different artificial illuminants. In comparing gas and electric lighting one may compare the money paid for gas or for electric energy, but to make a real comparison many other factors are to be taken into account. "In addition to the cost of lamps, mantles, etc., we

must remember that if an illuminant spoils the decorations, the extra cost of redecorating should be charged against it. Gas blackens the ceilings and destroys paint and so on; and the extra cost of decoration may be as heavy as the whole cost of electric light, in which case it does not pay to employ gas at any price. This argument annoys the gas industry, but it is sound and good."—Lond. *Elec.*, December 1.

*Hertz.*—A French translation of posthumous notes by Herman von Helmholtz on the life and work of Heinrich Hertz. These notes were originally published as an introduction of the German edition of the collected works of Hertz.—*Rev. Gen. des Sciences*, December 15.

*Export Business.*—PRENTISS.—An article giving hints on how to start a foreign trade. The author says that four steps are required: getting a lay of the land and a knowledge of the situation, creating a demand among consumers—best by personal solicitation—sometimes by advertising or other means, appointing agents and teaching them the goods and selling methods, learning to please the foreign customer and consumer. Foreign commerce takes time to build; it grows slowly; it requires the expenditure of much money.—*Am. Machinist*, December 28.

*Drawings.*—RONDINELLA.—A paper on the reproduction of drawings of great length or number by photographic methods.—*Proc. Eng's Club of Phila.*, October.

*Foundry.*—An illustrated description of the foundry department of the Olds Motor Works, of Lansing, Mich., which furnishes castings for the Olds Motor Works, for the Olds Gas Engine Company and for the American Suction Gas Producer Company. The equipment of the foundry and the method of shop management are described.—*The Foundry*, November.

*Electromagnetic Separqtion.*—An illustrated description of various types of electromagnetic separators, made by German firms, for iron ore concentration.—*Elek. u. Polyt. Rundschau*, November 15.

## BOOK REVIEWS.

DIE AUFGABEN DER PHOTOCHEMIE. By Dr. R. Luther. Leipzig: Johann Ambrosius Earth. 18 pages, Price, .80 mark.

This may be characterized as an immoderate, poorly balanced eulogy of photochemistry, by an enthusiast whose enthusiasm outruns scientific decorum and good sense. The occasion was the taking of a chair at the University of Leipzig, by Dr. Luther, and he certainly "let them have it." The body of the address deals in somewhat inconclusive glittering generalities, from which little real information can be gleaned, while the peroration of over a page deals out such stuff as:

"Eyes up! Observe with all five senses, so that nothing escapes our attention. Complain not, let us all rejoice! We will rejoice over the immeasurable field for work, over the inexhaustible scientific domain. We will collect each experience, utilize every scientific and technical advance for our purposes, extend our researches to the highest and the lowest temperatures, into the extremest ultra-violet and far past ultra-red to the longest electromagnetic waves," etc., etc.

ELEKTROLYSE GESCHMOLZENER SALZE. By Richard Lorenz. Vols. I and II. Halle: Wilhelm Knapp. Vol. I, 217 pages; Vol. II, 257 pages. Price, 8 marks.

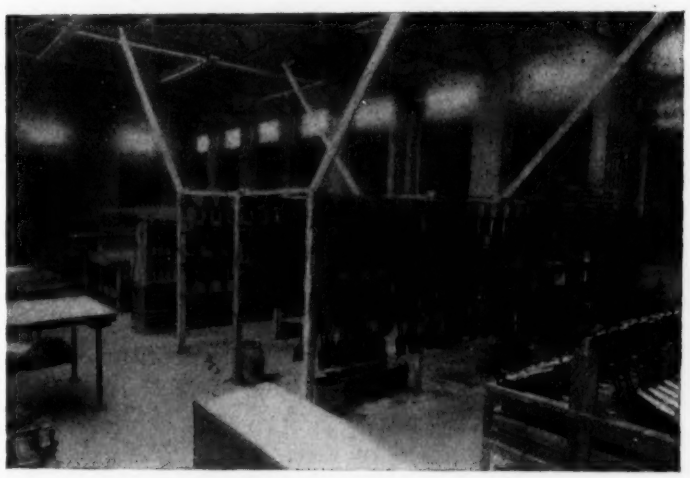
These two remarkable monographs are deserving of the best attention of everyone interested in electrolysis, purely scientific and applied. Prof. Lorenz and his students have given their especial attention during some years to the electrolysis of molten salts, and in this work we have a compilation of all that has been published by others, with numerous illuminating criticisms, and a very complete account of the contributions which have emanated from the Zurich Polytechnicum. Part I deals simply with the facts concerning the phenomena observed when various salts of the various elements are electrolyzed. The treatment is systematic, complete and will be the standard work of reference in this line. Part II deals with the conductivity of melted salts, the question of movement of ions in them and the application of Faraday's law. In this splendid treatise of 250 pages Prof. Lorenz lays bare the scientific foundations of the subject. He proves that Faraday's law applies absolutely and that solutions of metals in their own fused salts, analogous to colloidal solutions, play an extraordinary important rôle in electrolysis. Every electrochemist should buy and study both these monographs; they are unique in electrochemical literature.

## Growth of the Demand Indicator Business in the United States.

BY J. S. CODMAN.

The Wright Demand Indicator was invented by Mr. Arthur Wright, of Brighton, England, for use with the Wright Demand System of Charging for electricity. This system was introduced in Brighton in 1893 and was promptly followed by increased sales and income, by greatly improved load factor and by a large increase in the number of long-hour customers.

The first Wright Indicator in the United States was brought over from England in 1896 by Mr. R. S. Hale. In 1897 Mr. Wright himself read before the National Electric Light Association at Niagara Falls a paper entitled "Profitable Extensions of Electricity Supply Stations," in which he outlined his system in detail. This served to focus the attention of central station managers on the rate question, and the principles enunciated by Mr. Wright rapidly gained recognition. At the present time a demand system of some form based on these principles is in use



VIEW OF TESTING AND ASSEMBLY ROOM.

in the more prominent cities of the Union, such as New York, Chicago, Boston, Detroit, Cleveland, Cincinnati, St. Louis, Topeka, Denver, St. Paul, Minneapolis, Seattle, Rochester, N. Y., and Springfield, Mass., as well as in a large number of the smaller cities.

The manufacture of Wright Demand Indicators in this country was begun in 1898 by the General Incandescent Arc Light Company, of New York, which purchased the right from the English company. The business grew rapidly and was transferred to Pittsfield in 1903, where improved facilities were obtained and the present capacity of the works of the Stanley-General Incandescent Manufacturing Company is 1,000 indicators per week. The business continues to grow and for the first ten months of the present fiscal year, which dates from February 1, is already 34 per cent ahead of last year's total.

The accompanying illustration gives a general view of the testing and assembly room at the factory with three testing racks in the center and in the background to the left the zero-setting benches. After the zeros of the tubes are determined the instruments are assembled complete and then submitted to final test.

## Turbo-Alternator for Glasgow, Scotland.

Although the electrical details of turbo-alternators necessarily demand close attention, the most serious problems encountered in their design are those of a mechanical nature, on account of the high rotative speed. We are able to give below a description of a few of the mechanical and electrical features of a 3000-kw turbo alternator built by Dick, Kerr & Company, of London, for the Glasgow Corporation. The alternator has been designed to de-

liver three-phase currents at 6,600 volts, and having four-pole and operating at 750 r.p.m., it is a 25-cycle machine.

The stator completely wound is shown in Fig. 1. The frame is made of strong cast iron, and supports the stator laminations. The winding is embedded in slots, and insulated by means of pure mica. Special ventilating ducts are provided in the frame, and stiffening fingers clamped on the outside of the laminations obviate danger of vibration. The feet of the alternator frame are bolted to a special bed plate which is so arranged that the stator may be moved in a direction parallel to the shaft so as to uncover the rotor for easy inspection. Perforated shields protect the outside windings against accidental contact or mechanical injury, and are furnished with open spaces for ventilation. The outside of the high-tension windings is covered with sufficient insulation for the full voltage.

A view of the rotor is given in Fig. 2. The body is built up of a central solid steel casting cast under pressure with four projecting poles. This central body is machined and bored out to a

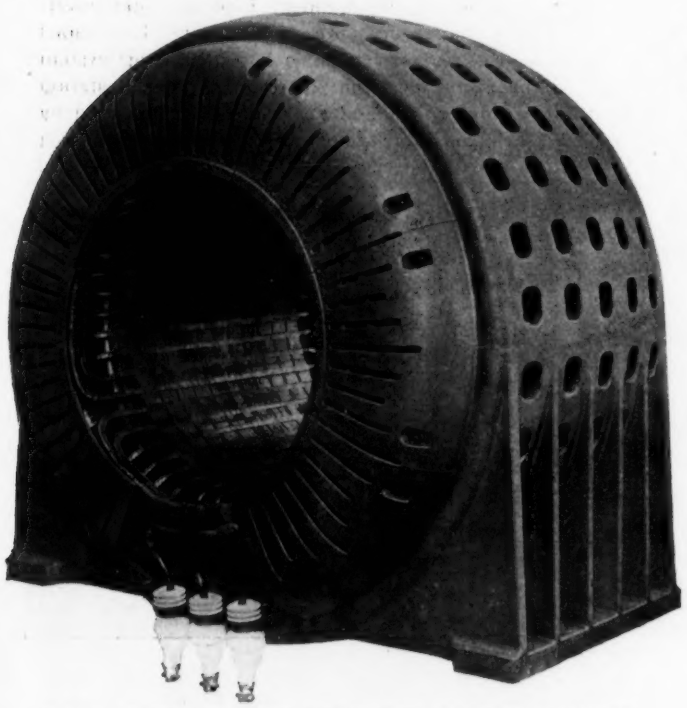


FIG. 1.—STATOR OF TURBO-ALTERNATOR, SHOWING ARMATURE WINDINGS.

diameter larger than the shaft. Two cross-shaped pieces are built at each end of the central body, and carry the rotor on the shaft. These parts are so arranged in reference to the shaft as to leave an annular space all around for ventilation. On the central body radially drilled passages are provided, which correspond to air ducts in the laminated pole tips, these being in line with openings left in the stator iron. The pole tips are laminated, and are dovetailed on the steel casting of the central body. Special end pieces, also dovetailed on the steel casting, retain the laminated tips in position and at the same time act as checks against centrifugal force to keep the spools in position. To guard against centrifugal force which would tend to spread the field coils, laterally wedged pieces are inserted between adjacent coils, pressing against them and the laminated pole tips. The field winding is built up of solid copper strip wound on edge, insulated between turns by means of paper and mica, and supported in a special copper spool with heavy insulated flanges. The spools, after being formed and insulated, are subjected to hydraulic pressure in the axial direction of about 50 per cent over the pressures to which they would be subjected from centrifugal action in normal running. The copper winding of the field bears flat on the insulation, thus avoiding any danger of cutting. The terminal leads of each spool are carried out on the bottom of the spool, and are composed of very thin and flexible copper strips. Between the spools, special wedges are provided against the horizontal component of the centrifugal force, which tends to open the spools. The spools, after being assembled and connected up, are finished on the outside surface, where otherwise the copper would be bare, by means of a special varnish, which is oil and waterproof, and presents a very hard and glossy surface, making it easier to clean the machine. The shaft is special pressed steel and finished all over, and the rotor is pressed over it with about 100 tons pressure.

The collector rings are of manganese bronze, fixed over a solid steel sleeve, and of special construction so as to make it

FIG. 2.—ROTOR, SHOWING ARRANGEMENT OF FIELD WINDINGS.

impossible to be subject to deformation under working conditions; the collector rings are shrunk hot over special micanite rings, which are built up directly on the steel shell of the collector rings. The leads from the field coils are carried to the collector rings and are protected by means of special metallic caps which are fitted over the shaft and to the end of the rotor body. The connection of the leads to the collector rings is also protected by a special cap, which is easily removable for inspection if necessary. The finished appearance of the collector rings and rotor body is such as not to have any loose connection or projecting part, making it possible to keep the machine clean when running.

Fig. 3 shows the performance characteristic of the turbo-alter-

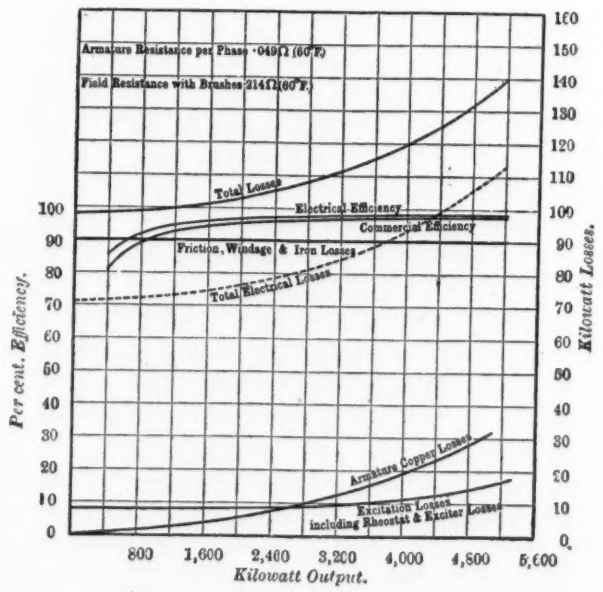



FIG. 3.—TEST OF 3,000-KW ALTERNATOR AT 6,700 VOLTS, 750 R.P.M.

nator when operated at 6700 volts. The losses shown include also those due to the exciting dynamo. The exciter is connected to the alternator shaft by means of a flexible coupling.

## Improved Telephone Transmitter.

A telephone transmitter which the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is just putting on the market, possesses several features which serve to distinguish it from the usual form of transmitter. In the transmitters now in use only one of the electrodes is vibrated with the diaphragm, and in the better forms this one electrode takes up the same amplitude of vibration as the central point of the diaphragm, which, of course, is the point of maximum movement. In the new transmitter both of the electrodes are attached to the central point of the diaphragm and thus produce a variation in the distance between the electrodes of twice the amplitude of vibration of the central point of the main diaphragm. It is evident that a transmitter constructed along these lines will produce a greater volume of transmission than if only one of the electrodes is movable.

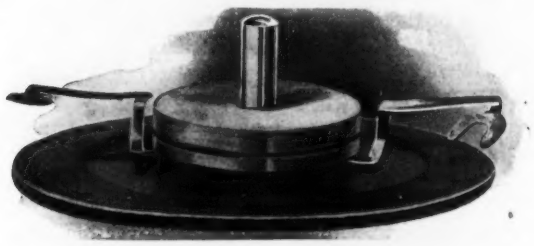


FIG. 1.—DIAPHRAGM WITH CONNECTORS AND CUP.

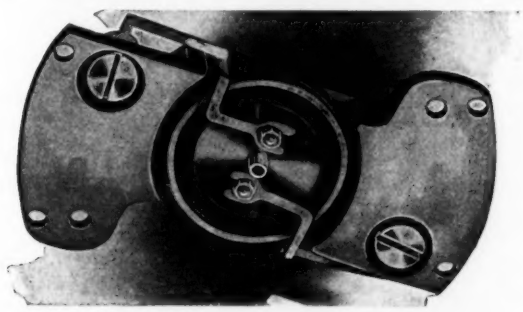


FIG. 2.—FRONT VIEW OF CUP WITH DIAPHRAGM REMOVED.

The mechanical construction of the transmitter follows out the practice that has been found to be the most satisfactory for high-class appaartus; that is, the use of highly-polished carbon electrodes and irregularly formed carbon granules enclosed in a practically moisture-proof case, using no absorbent material whatever, so that the transmitter when once assembled should be entirely free from any bad effects due to atmospheric changes, and should be equally efficient in any climate. The transmitter is made durable, particularly in damp climates, by the use of an auxiliary moisture-proof diaphragm over the main diaphragm, thus preventing any chemical action of the main diaphragm, due to moisture of alkali from the breath.

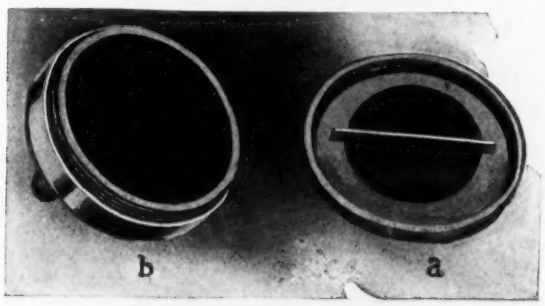



FIG. 3.—TRANSMITTER CUP.

The construction of the instrument is clearly shown by the accompanying illustrations. It will be noted that what corresponds to the front electrode in the ordinary transmitter, is divided into two halves, each forming a terminal. The back disc with highly polished carbon is used only as an electrical connection between the two halves of the transmitter. Fig. 1 shows the diaphragm with the connectors and cup attached. Fig. 2 shows the front view of the cup with the diaphragm removed, and the method of fastening the connectors to the electrodes. Fig. 3 shows the cup dismounted with the granular carbon removed; *a* shows the front of the cup with the electrodes fastened to the auxiliary mica diaphragm; *b* shows the cup with the back carbon disc. Fig. 4 illustrates the parts of the cup; *c* is the back or neutral carbon disc; *d*, the cup; *e*, the separating ring; *f*, the electrodes and mica diaphragm; *g*, the clamping ring.

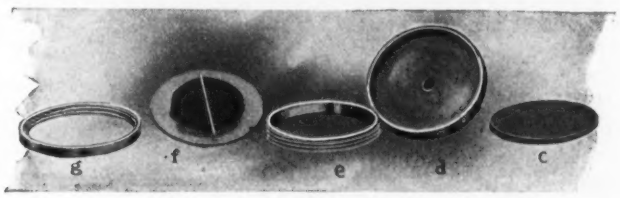



FIG. 4.—PARTS OF TRANSMITTER CUP.

The carbon electrodes used in this transmitter are manufactured of a special grade of very dense carbon properly treated, so that it is of exceedingly low resistance, and they are securely soldered to the connecting discs without the use of any salts or acid. The diaphragm is made of extra hard aluminum, and is protected by a celluloid disc. The auxiliary diaphragm for sealing the carbon cup is made of selected India mica, and is securely held in place by the clamping ring. No metal whatever is used in the construction of the transmitter excepting brass, thus insuring against the warping which may occur when composition parts are used.

## Central Station Employees and the Company.

Believing that the relations between the employees of a corporation and those directly responsible for the success of its business could be cultivated and developed in a manner inuring to the benefit of all concerned, the Edison Electric Illuminating Company of Brooklyn made a very interesting essay in this direction last month, when it invited 1,200 of its employees and members of their families to participate in an entertainment at the general offices and to witness an exhibit of apparatus applied to purposes of the home, the office, the family, etc. The idea was cleverly worked up and the programme was carried through admirably. The musical programme, for example, included exhibits with talking machines and by the electric piano. In addition to these, exhibits were made of electric cooking and heating apparatus, of Christmas tree illuminations, of Cooper Hewitt lamps, of electric sewing machines, of electric massage outfits, of Gray writing telautographs, of wireless telegraph out-

BROOKLYN EDISON EXHIBIT.

fits in actual operation, of heavy electromagnets for surgical and other uses, of the Poulsen speech-recording telegraphone, of the Autarith calculating machine, of the Edison business phonograph and of modern office appliances. This was supplemented by a display of meters under the care of the meter department. The idea was to give emphasis to apparatus requiring central station current for its operation and to familiarize the employees in all departments with the opportunities of the most diversified kind that existed for pushing the business of the company in their own homes as well as those in the thousands of customers.

It is interesting to understand that a direct and perceptible impetus was given to the work of the company by this admirable entertainment just before Christmas, and the vice-president, Mr. W. W. Freeman, is to be congratulated upon the scheme. An illustration of the company's methods is further afforded by the fact that quite recently Mr. Freeman organized a class of sixty at the Pearl Street headquarters who are undergoing a practical business training and education through one of the correspondence schools, the company paying the entire expense of the work, as it is considered a profitable investment in improving the effective status and ability of the employees in the business department. The electric cooking and heating exhibit, in charge of Mr. Max Loewenthal, and with Miss Helen Tovell, as demonstrator, is herewith illustrated.

## Westinghouse Electrostatic Voltmeter.

The Westinghouse Electric & Mfg. Co. has placed on the market a new form of electrostatic voltmeter in which the obstacles met heretofore in the design of an instrument of this type for general commercial work have, it is claimed, been entirely overcome. This instrument, which is illustrated herewith, is stated to require for its operation a negligible amount of energy, and to be free from the effect of variation of wave form.

The operating elements are immersed in a special grade of oil contained in a metal-lined wooden case with an insulated cover. The metal lining acts as a screen to prevent outside fields or influences from affecting the meter. As the insulation is one of the most important parts of an instrument of this type, a few of the advantages derived from the use of oil may be summarized as follows:

(1) The distance between the operating elements may be greatly lessened, thereby reducing the size of the instrument. (2) The actuating forces are greatly increased, due to the smaller distances between active parts and the high specific inductive capacity of the oil. (3) The reduction in distance between working parts of the meter makes possible a better form of scale. (4) The oil acts as a damper and makes the instrument nearly dead beat and easy to read. (5) The oil buoys up the moving element, thus removing practically all weight from the bearings.

The arrangement and relative position of the parts of the meter are shown in the diagrammatic sketch. The curved plates, $B_1$ and $B_2$, are of such a shape and so arranged with respect to the moving element that a deflection in a positive direction shortens the gap between it and the plates. The charges induced on the two extremities of the moving element are of such a nature that they exert forces of atraction on the charges on the plates, which bring about such a movement. The turning of the moving element is restricted by a spring and the deflection of the pointer is read on the scale. The condensers, $C_1$ and $C_2$, are in series with other parts of the instrument, one plate of each being metallically connected to a curved plate, and the other to a terminal.

The curved plates, with the condenser plates attached are supported from the insulated cover by means of grooved posts of able insulating material. The separate condenser plates are supported in a similar manner. As all parts are firmly fastened to the same base, they are held in constant relation to each other, and no error can result due to disarrangement of parts. The height of the oil in the case, together with the long paths over the suspension posts, prevent leakage between the plates. The horn-shaped terminals extend to the same distance below the oil as the suspension posts and are also grooved to prevent leakage over their surface.

The bearing springs and adjustments are similar to corresponding parts of Westinghouse standard indicating instruments.

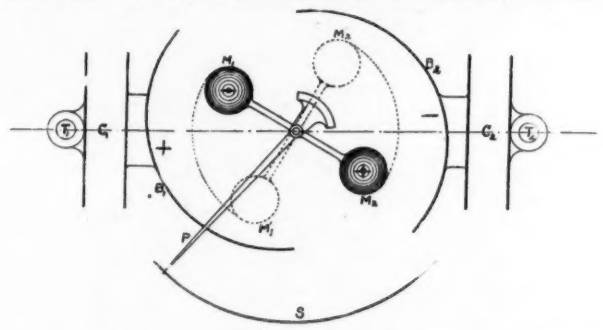
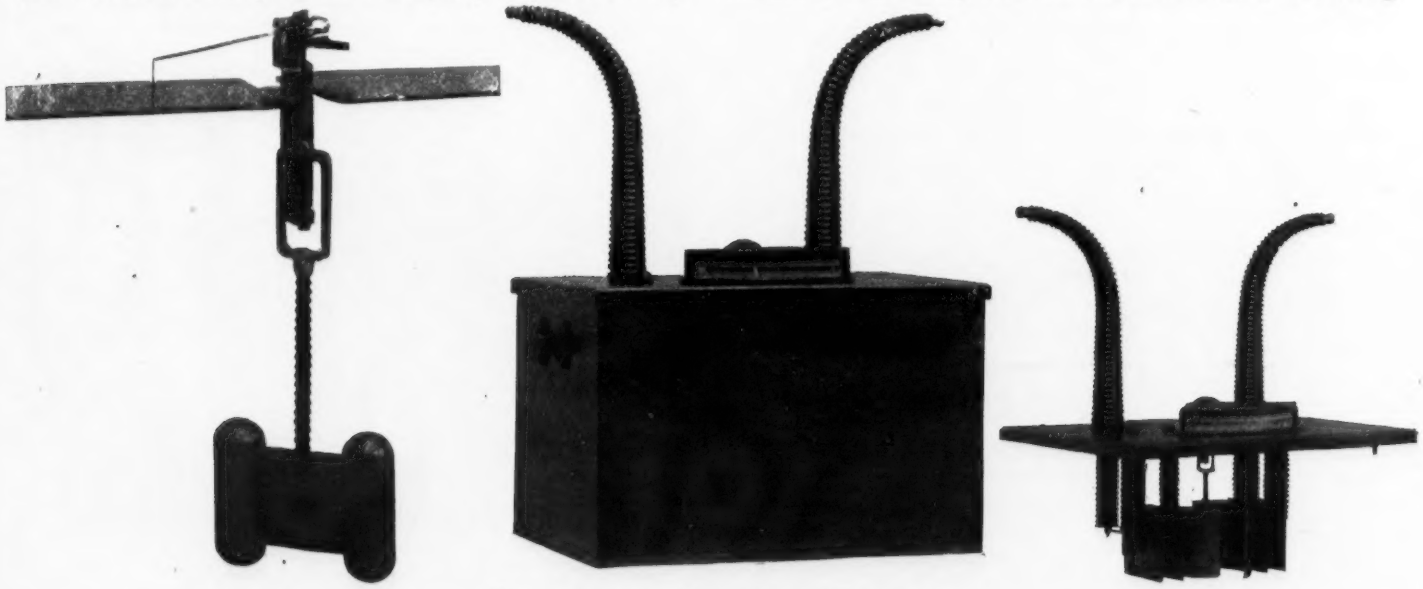



FIG. 4.—DIAGRAMMATIC SKETCH OF ELECTROSTATIC VOLTMETER.

The cylindrical parts of the moving elements are hollow, and so proportioned that the buoyant effect of the oil removes almost all weight from the bearings, thereby eliminating friction and wear. The scale over which the pointer passes is placed on an edgewise cylindrical form similar to the scale of an edgewise switchboard instrument, and the reading may be taken from a safe distance. With the exception of the glass window through which the scale is read, the cover over the pointer is all metal, and acts as a screen to prevent external static fields from affecting the pointer. Instruments of this type may be obtained for potentials as high as 200,000 volts. The one shown in the illustrations may be used for voltages up to 100,000 volts with the condensers in circuit, or for approximately 50,000 or 25,000 volts with one or both condensers short-circuited. The case is 22 in, long. 18 in. wide, and 15¼ in. high, with terminals projecting, as shown, 18 in. above the case.



FIGS. 1, 2 AND 3.—ELECTROSTATIC VOLTMETER.

## Nernst Lamps vs. Gas Arcs.

Many valuable suggestions for central station managers are contained in a recent issue of the *Nernst Central Station Bulletin,* which calls attention to a few instances demonstrating what can be done with the Nernst lamp in anti-gas campaigns. It is said that in the State of Massachusetts alone Nernst lamps have replaced at least 3,000 gas arcs within the year ending November 30, 1905. A few of the cities are treated specifically. At Lowell the Electric Light Corporation sells electricity on a sliding scale at from 18 cents to 8 cents per kw-hour, in competition with gas at 90 cents per 1,000 cu. ft. This company has recently put in about 600 glower units, replacing two, three and five-burner gas arcs. With electricity at 15 cents per kw-hour and gas at $1.20 per 1,000 cu. ft., the Pittsfield Electric Light Company has installed about 400 three-glower lamps, each of which replaced a four-burner gas arc.

The Salem Electric Light Company, which sells electricity at 10 cents in opposition to gas at $1.20, has installed 600 three-glower Nernst lamps, which have replaced about the same number of gas arcs. It is stated that the cost for maintenance of these Nernst lamps averages about 7 mills per kw-hour. At Cambridge there have been installed 51 six-glower and about 400 three-glower Nernst lamps, which have replaced gas arcs in almost every instance. The lamps are furnished on contract for one year, electricity being supplied at the rate of 20 cents per kw-hour for the first 400 hours per year and 10 cents per kw-hour for all succeeding hours. Each rate is subject to a discount of 15 per cent. The gas consumer at this place owns his gas arcs, paying $1.00 per 1,000 cu. ft. for gas and 50 cents per lamp month for maintenance. The Cambridge Electric Light Company is maintaining all Nernst lamps and it has publicly stated that the cost has as yet not exceeded 5 mills per kw-hour.

## Automatic Time Switch.

The Hartford Time Switch Company, 97 Warren Street, New York, is placing on the market a new type (Type F) of automatic switch which is the result of a number of inquiries received

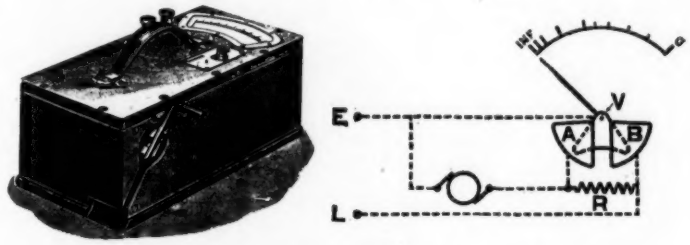
AUTOMATIC TIME SWITCH.

from central stations for a switch that could be located inside of the hollow electric light poles that are now coming into general use in the larger cities. The switch is made extremely compact, and will fit into any pole having an inside diameter of 6¾ in. and an opening of 3½ in. by 10 in.

A Seth Thomas eight-day lever movement is used to operate the switch, and is so arranged that it is entirely separated from the switch proper. By this means the quick operation of the switch in making and breaking does not in any way bring any strain upon the time train or affect the accuracy of the clock. The company states that for a considerable period a number of these switches have been in successful operation on street circuits in different cities, and in every case the trials have resulted in its adoption for permanent service.

## Insulating Testing Set.

The accompanying illustrations show an insulating testing set which possesses several unique features. The complete equipment consists of a direct-current magneto-generator and an electrostatic ohmmeter combined in one case. The ohmmeter consists of a




FIGS. 1 AND 2.—TESTING SET AND DIAGRAM OF CONNECTIONS.

vertical needle with 15 parallel vanes about .3 of an inch apart. These work into sets of fixed inductors of specially calculated shape.

The method of working can be learned from Fig. 2. The generator has one of its terminals attached directly to one quadrant, *A,* of the electrostatic ohmmeter, and the same terminal attached through a resistance, *R,* to the other quadrant, *B,* of the ohmmeter. The other terminal of the generator is connected to the vane, *V.* The quadrant, *B,* is attached to the line to be tested and the vane, V, is attached to earth.

When the insulation between the earth and the line is infinite, there is no current flowing through the resistance, *R,* and the vane, *V,* takes up the position shown on the diagram. When a current flows from *E* to *L,* there is a drop of potential due to the current flowing through *R*; the quadrants, *A* and *B,* are then at different potentials, and the vane, *V,* takes up a new position, which position is determined by the difference of potential and the shape of the vane.

This testing set is manufactured by Nalder Bros. & Thompson, Ltd., 34 Queen St., Cheapside, London, E. C.

## Vertical Shaft Frequency-Changers for Chicago.

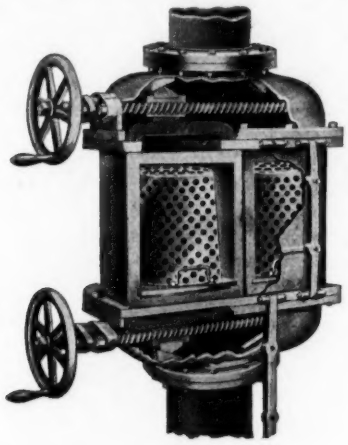
The Commonwealth Electric Company of Chicago has placed orders with the General Electric Company for some motor-generator frequency changers with vertical shafts. These units will have step or thrust bearings at the lower end of the shaft similar to the step bearings perfected for use on the Curtis turbine. In fact, the machine is a direct result of the development of the vertical shaft steam turbine in which the weight of the shaft and revolving parts is taken by fluid pressure in the step bearing. The units ordered are each of 1,000 kw capacity, and will run at 300 r.p.m. They consist of a synchronous motor taking three-phase, 25-cycle current at 9,000 volts and driving a three-phase, 60-cycle, 2,200-3,800-volt star connected generator for supplying the Commonwealth three-phase, 4-wire distribution system.

The advantage obtained by the use of a vertical shaft machine with a fluid step bearing is that the machine occupies less space; and the friction losses are less than with a horizontal shaft. The low friction losses on the Curtis turbine have been a matter of note among those operating them for some time. If left free to run with steam shut off, they will run for hours. The construction of vertical shaft rotary converters of this type has not been attempted because of the absence on a vertical shaft machine of the end play which is apparently necessary to give

good commutator wear. On a motor-generator frequency changing set this objection does not exist. The low friction loss in this vertical shaft type of machine is, of course to be accounted for by the fact that most of the weight floats on the fluid of the step bearing.

## Feed-Water Strainer.

The "Twin" strainer illustrated herewith is, as its name implies, two strainers in one, which are alternately thrown in and out of action by simply operating a pair of valves, the one not in use being accessible for cleaning. The apparatus consists of a casing having two passage ways, each containing a basket shaped strainer removably secured in the side of the casing forming perforated pockets which catch and retain the dirt in the water. By a simple arrangement of the valves the flow of the water (or any other liquid to be strained) is caused to pass



FEED-WATER STRAINER.

through one basket while the other being out of service can be cleaned and replaced without interrupting the flow.

Access to the basket for cleaning is had through doors in the front of the casing, and, as the idle basket is not under pressure, or suction, as the case may be, it can be removed, cleaned and replaced in a few minutes, the door replaced, when this basket is again ready for service. On account of the ease and rapidity of manipulation, it is stated that the strainer will handle water containing any amount of solid matter.

This apparatus is built by the Liberty Manufacturing Company, 6910 Susquehanna St., Pittsburg, Pa.

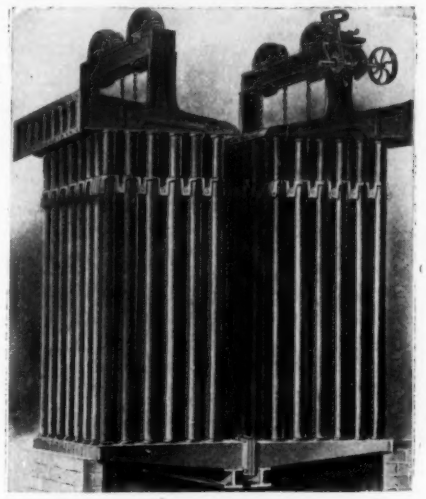
## Air Heater.

Small boiler plants waste a large proportion of the heat of the fuel, and any device which would make it possible to save a considerable part of this should be of interest to many. Air may be heated and dried, in the same way that water is heated in an economizer, by the waste heat in the flue gases, and the Green Fuel Economizer Co., Matteawan, N. Y., has recently introduced a device for this purpose.

As seen in the accompanying illustration, the air heater is constructed substantially like an economizer, with the exception, however, that, while in the economizer all the water enters at the bottom header and passes out from the top header, in the air heater the air is forced by a fan first down through one set of tubes and up through another set, and then down again, and so on until it leaves the heater to be distributed by pipes to drying chambers, work rooms or other places where it is to be used.

The cold air from the blower enters the heater at the end where the flue gases leave to pass the chimney, while the heated air is taken out at the end nearest to the boiler, where the flue gases are the hottest. In this manner a uniform and high difference of temperature is maintained between the flue gases outside the tubes and the air inside the tubes, a condition required for the most rapid transfer of heat through a given amount of conducting surface.

These heaters have for some time been in successful operation in steam laundries, textile mills and hospitals. In laundries,

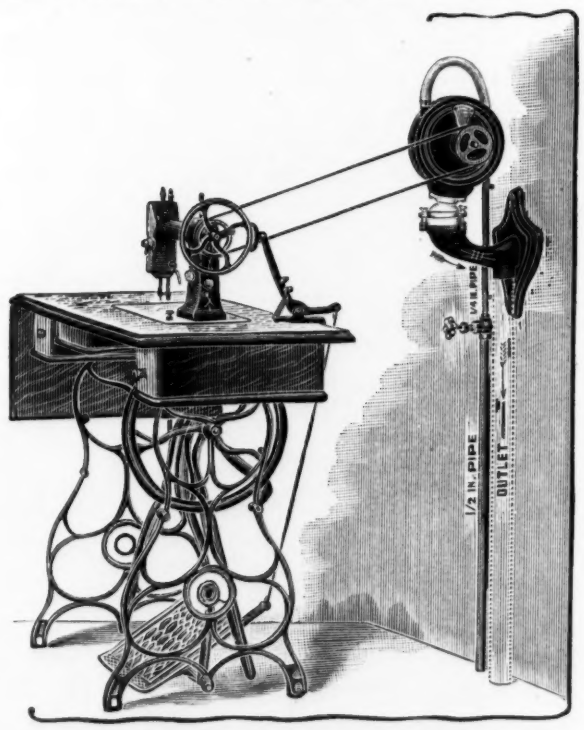


AIR HEATER.

the heater and the economizer can be worked together very nicely, the economizer furnishing the hot water for washing, etc., and the heater, the heated air for drying the clothes.

## Water Motors.

The accompanying illustration shows a small water motor put to domestic use. The motor is mounted on a hollow bracket through which the water flows from the wheel to the outlet. The ball joint is made of brass accurately turned, so that it forms at all times a perfectly water-tight union and yet permits adjust-




WATER MOTOR DRIVING SEWING MACHINE.

ments readily to be made. The wheel is of the impulse type, numerous buckets being riveted to the outer edge of the disc of the wheel. The admission nozzle, which extends into the casing, is of a size such as to use from six to ten cubic feet of water per hour for driving a fan motor, and a proportionately larger amount is required for power motors. These motors are built by the A. Rosenberg Motor & Manufacturing Company, Baltimore, Md.

# Industrial and Commercial News

## *Commercial Intelligence.*

THE WEEK IN TRADE.—Business in commercial lines lagged somewhat, merchants being in the midst of stock-taking and therefore not disposed to secure fresh supplies. As a rule, however, prices had a higher tendency. The unseasonable weather had an adverse effect upon retail trade and on reorders from wholesale, but, on the other hand it favored outdoor activities and facilitated railroad transport. More activity is shown in spring trade and requests for prompt shipment are being received earlier than usual. The month of December last was perhaps the best month of the year for railroads, the gain in gross earnings over those of the same month in 1904 being 12 per cent. The railroads have still six months of large business in sight. As to general trade and industry, the general belief seems to be that 1906 will be very active. Manufacturers entered the year with a heavy volume of business booked and with excellent prospects for a continuance of activity. In iron and steel business is of an excellent character for a period that is usually dull. Pig iron shows strength, and a heavy buying movement is expected shortly. Leaders in the industry predict a great scarcity of pig iron within the next three months. Steel-rail makers announce additional orders, and indications are that 1906 will exceed all previous years in this line. Bridge builders report a goodly volume of business, and makers of structural shapes are actively engaged. Within the past fortnight or so foreign mills have made additional sales in this country. Wire products are very strong. The copper market at home and abroad is firm. The London metal market's story about immense reshipments of ingot copper from China is discredited by copper buyers in Europe and America. For three months large metal users here and in England have been trying through agents in China to buy copper so as to depress prices in the Occident, and they have found that the bulk of the copper shipped to China has gone into consumers' hands. European copper manufacturers have already taken nearly all the copper that was on the market in China and Japan. The domestic copper markets are quiet with fully sustained high level prices for immediate delivery. That there is a legitimate shortage of copper for immediate delivery hereabouts is shown by the fact that several copper and brass rollings mills in the Middle and Eastern States which usually start up after the holidays are still shut down. The managers of these plants say that they are waiting for copper on contracts soon to expire and that they expect to pay not less than 18½c. to 18¾c. per lb. through this year. Local quotations for lake and electrolytic copper are 18⅞c. and 19c.; casting copper, 18⅜ and 18⅞c. For immediate delivery, in lots of 10,000 to 15,000 lbs., buyers are paying 20c. per lb. at Eastern and Middle Western distributing points. The market for aluminum is active under orders from electrical apparatus makers, who are substituting it for copper. The output of domestic aluminum has increased tenfold in as many years. Last year's domestic production was 9,250,000 lbs. *Bradstreet's* reports 220 business failures in the week ending January 4th, against 212 the week previous, and 278 the corresponding week in 1905. Failures for 1905 were slightly below the average of the past six years, numbering only 9,970, as against 10,422 in 1904, a decrease of 4 per cent. from the latter year, an increase of 3 per cent. over 1903, about the same number as in 1902, and only 3.4 per cent. more than in the year 1899, which saw the smallest number for a generation. Liabilities aggregated $121,770,000, a decrease of 15 per cent. from 1904, of 21 per cent. from 1903, and an increase of only 15 per cent. over 1902. Large failures were less numerous and damaging than in 1904, but the decrease was entirely in commercial and manufacturing lines, as bank failures, though not quite as numerous, were just as hurtful as regards liabilities as in 1904. The South alone showed any important increase in the number failing as compared with 1904, and the Northwest and South, owing to bank failures, showed only increase in liabilities.

TRADE IN MANUFACTURES.—It is encouraging to note that manufacturers participated to the extent of more than a billion dollars in the two and a half billion dollars' worth of commerce of the United States during the eleven months ending with November, 1905. Figures just supplied by the Department of Commerce and Labor, through its Bureau of Statistics, show that the value of manufacturers' materials imported in the eleven months ending with November was 513 million dollars, and of manufactures exported, 520 million dollars, speaking in round terms. This by far exceeds in both imports of material and exports of manufactures the figures of any earlier year and suggests that the total for the full calendar year 1905 will be approximately 550 million dollars' worth of material imported for use in manufacturing and 570 million dollars' worth of manufactures exported. It will exceed by far that of any preceding year both in the imports of material for use in manufacturing and in exports of manufactures. In exports of manufactures the figures for the eleven months were 520 millions, against 459 millions in the same months of last year. It was not until the calendar year of 1904 that manufactures exported ever reached a total of 500 million dollars, but in the calendar year 1905 they seem likely to approximate 570 millions, since the exports of the single month of November were over 48 million dollars, and suggest that December will probably add about the same amount to the eleven months' figures of 520 millions already recorded. In the calendar year 1904 the value of manufactures exported was 502 millions, having for the first time crossed the 500-million line, and it is thus quite apparent that the figures of the calendar year 1905 will be at least 10 per cent. in excess of those of the record year 1904. Imports of manufacturers' material increased 81 million dollars during the eleven months and exports of manufactures increased 60 millions.

TRADE WITH GERMANY.—Trade between the United States and Germany in the fiscal year 1905 aggregated over 300 million dollars. The imports from Germany were 118 million dollars in value and exceeded imports from that country in any earlier year. The exports to Germany were 194 million dollars in value and exceeded our exports to that country in any earlier year except 1904, in which the total was a little over 214 millions, this decrease in 1905, compared with 1904, having occurred in raw cotton and being due altogether to a fall in price, since the quantity in 1905 was greater than in 1904. Comparing conditions in 1905 with those of a decade earlier, it may be said that our imports from Germany have grown from 81 million dollars in 1895 to 118 millions in 1905, while out exports to that country have grown from 92 million dollars in 1895 to 194 millions in 1905. Thus our imports from Germany increased 37 million dollars in the period from 1895 to 1905, and our exports to that country increased 102 millions in the same time. In the more advanced grades of manufactures, such as scientific instruments, typewriters, and sewing mamchines, our exports to Germany show considerable growth as compared with a decade ago, but no material change in recent years. Typewriters, for instance, which amounted to but $228,710 in 1897, were $454,625 in 1900 and $846,601 in 1905; sewing machines, in 1895, $472,203, and in 1905, $982,558, and scientific instruments, in 1895, $135,333, and in 1905, $539,309.

RAILWAY REBATES.—It is stated that agents of the Interstate Commerce Commission have discovered evidence that the General Electric Company has for seven years received a rebate of 20 cents a ton on all freight shipped out of Schenectady over the New York Central and the Delaware & Hudson. Last year's rebates on shipments from all the company's plants are said to have been $200,000. Secretary Westover, of the electric company, admits the 20-cent reduction, but points out that it is only an allowance because the company switches its own freight in the yards and turns over full carloads. Anyone who has visited Schenectady has had opportunity to see how the locomotives of the great works there relieve the steam lines of all switching.

MATERIAL FOR URUGUAY.—La Comision de Luz Electrica, of Monte Video, Uruguay, South America, F. C. Boutell, technical engineer, would like catalogues and price lists of electrical machinery, steam plant, turbines, arc lamps, carbons, incandescent lamps, fittings, instruments, cables, etc. Mr. Boutell informs us that the present supply station erected in 1887-8 with a present capacity of 3,500 kw in steam alternators is to be entirely reconstructed. At the same time a plant is being put in for street railway work and cables are being laid under ground.

BALTIMORE AFFAIRS.—Baltimore has recovered magnificently from the great fire and her industries thrive. As to electrical developments, correspondence says: "The Consolidated Gas Company has been joined with the United Electric Light & Power Company under the name of the Consolidated Gas, Electric Light & Power Company. Both concerns were doing an excellent business before the consolidation, and are understood to be equally prosperous now. Opposition has developed in the Maryland Telephone Company, which has formed a rival electric lighting company that is making a strong bid for business. At present the topic uppermost in the minds of Baltimore financiers is the refinancing of the United Railways Company. The property needs improvements badly and is receiving them from funds that would otherwise be used to pay the interest on the income bonds, which are cumulative. A strong faction is opposed to the policy of the management, which controls the majority of the common stock, and all manner of plans have been suggested to be discarded."

GENERAL ELECTRIC SINGLE PHASE.—The Toledo & Chicago Interurban Railway Company has been equipped with the General Electric single-phase system and will soon be operating about 50 miles around Fort Wayne, Ind. The power house at Kendallville has two 800-kw, 25-cycle Curtis turbine generators and will supply current to the trolley at 3,300 volts at the power house, while sub-stations will receive 33,000 volts from transmission lines supplied by step-up transformers in the power house. For the rolling equipment for the 50 miles, ten four-motor General Electric 75-hp single-phase alternating-current compensated type equipments are being furnished, operating eight passenger and two package freight cars. Each car equipment is furnished with a trolley, air compressor and air brake. The air compressor is driven by a compensated motor operating on both alternating current and direct current. The line equipment is 000 catenary construction trolley and three No. 2 copper high-tension line.

POWER AT LEWISTON, ME.—The large masonry dam, which has been in course of construction near Sanford and Springvale for some time, has been completed. The power developed will be utilized by the Goodall industries at the two towns mentioned, and by the Atlantic Shore Line Company and the Sanford Power Company. The Alfred Light & Power Company is also controlled by the Atlantic Shore Line. The dam was built at a cost of $100,000; it is 950 feet long, 60 feet wide at the bottom, 8 feet wide at the top and has a spillway of 470 feet. One of the two penstocks will supply the turbines at the power house, which will be erected directly below on the western shore, while the other will feed the pond at Old Falls. This reservoir will comprise 106 square miles and will have an average depth of 18 feet.

ENLARGING LOCOMOTIVE WORKS.—The American Locomotive Company, of Schenectady, associated with the General Electric Co. in the production of electric locomotives, in addition to its steam product, will spend $500.000 in further improving its plant in that city. Concrete foundations are being laid for a mammoth erecting shop, 160 by 360 ft., which will contain pits for thirty-four locomotives. When the new building is completed the old erecting shop, containing seventeen pits, will be used as a running shed for locomotives. The new carpenter shop is also well under way. The improvement will mean employment for many more men, as well as a substantial increase in the output of the local works.

CONVEYOR ORDERS.—The Robins Conveying Belt Company, of New York, has recently secured an order from B. Altman & Co., of New York City, for conveyors for handling packages at their new store on Fifth Avenue. One of the requirements of this conveyor system is that it can be operated without the least noise. Among other work that the Robins Co. now has on hand is an order for a large system of conveyors for the Caucasus Copper Company, of Russia, and an order from the Bethlehem Steel Company for a belt conveyor for handling sand at their foundry at South Bethlehem, Pa.

RAILROAD TELEPHONY.—The American Telephone & Telegraph Co. is at present installing for the Illinois Central Railroad a through telephone line from New Orleans to Louisville. Some time ago the railroad company put in a telephone system. This line was equipped with small wire and the result was that it could never be used over more than half the distance on account of resistance. The present move is practically a reconstruction of the old line, and full-sized long distance wire will be used.

LAMP REFLECTORS.—In a decision by Thaddeus S. Sharretts, the Board of United States General Appraisers has overruled a claim made by Leo Popper & Sons, New York, it being held that reflectors for lamps are properly dutiable under the Dingley tariff at the rate of 45 per cent, under the provision for manufactures of glass and metal. The importers contended for lower duty, but the board found their claims to be without merit.

NORTHERN TRAVELING CRANES.—The new Robb Mumford Boiler Works, of South Framingham, Mass., have installed four electric traveling cranes and riveter hoists manufactured by the Northern Engineering Works, Detroit. One of 25 tons capacity, 50-ft. span, 4-motor design, one 5 tons 28-ft. span, 3-motor, and two electric riveter cranes of 20 and 15 tons capacity, with 50-ft. lift.

THOMPSON-STARRETT COMPANY, 51 Wall Street, New York City, in a new year announcement state that among a lot of other work they now have under construction four power houses.

## *Financial Intelligence.*

THE WEEK IN WALL STREET.—A bullish tendency prevailed in the stock market early in the week, and new high records were established in various prominent speculative stocks. The high money rates, however, exerted a quieting influence on the market, which was also affected by heavy breaks in Anaconda mining shares. At the end of the week there was more strength on easier money. The United States Steel issues retained their prominence, common selling up to 43½ and preferred to 107, the support being due to the satisfactory condition of the steel trade and the earnings of the corporation. The industrials generally were firm. American Locomotive common, of which 198,700 shares were sold, closed at 77⅜, which is an advance of 1½ points, and preferred closed at 117½, a net gain of ½. The electric group of stocks were all strong and active, and closed at advanced figures. Allis-Chalmers common's final quotation of the week was 23⅜, a net gain of 1⅛, and preferred 63, an advance of 1⅜. General Electric made a net gain of 2½ points, closing at 179½, and rights sold at 9⅞, an advance of ⅜ on the week's business. Westinghouse made a net gain of 4½ points, the last quotation being 174½. The traction list was weak in tone, and prices of all the principal stocks reflected this condition. Brooklyn Rapid Transit closed at 88⅝, and Metropolitan Street Railway at 124, the latter quotation being a loss of 1 point. Interborough Rapid Transit declined 3½ points on the curb market, closing at 232. Western Union is quoted at 93⅜. The curb market during the week underwent a variety of movements, with an uplift at the beginning, followed by general declines on profit-taking sales, and another bidding up at the end of the week. Compared with a week ago, quite a number of stocks are lower. This is the case with the contracts for new Metropolitan Street Railway shares, and in the case of Interborough. A number of copper stocks are also lower. Trading was on a somewhat smaller scale than in the previous week. There was some demand for bonds, particularly of the new Metropolitan Street Railway Company, these being much more active than the contracts for the shares. Following are the closing quotations of January 9:

NEW YORK

| | Jan. 2 | Jan. 9 | | Jan. 2 | Jan. 9 |
|---|---|---|---|---|---|
| Allis-Chalmers Co | 22⅛ | 23 | General Electric | 177¼ | 178½ |
| Allis-Chalmers Co. pfd | 61¾ | 62 | Hudson River Tel. | .. | ... |
| American Dist. Tel. | 37 | 37 | Interborough Rap. Tran. | 231 | 232¼ |
| American Locomotive | 72⅛ | 7 6 | Mackay Cos. | 58¾ | 58¾ |
| American Locomotive pfd. | 116 | 117 | Mackay Cos. pfd. | 73½ | 73 |
| American Tel. & Cable | 90 | 90 | Marconi Tel. | .. | ... |
| American Tel. & Tel. | 135 | 136 | Metropolitan St. Ry. | 124⅜ | 124⅜ |
| Brooklyn Rapid Transit | 87⅞ | 88⅜ | N. Y. & N. J. Tel. | .. | ... |
| Electric Boat | 28 | 28 | Western Union Tel. | .. | 93⅛ |
| Electric Boat pfd. | 70 | 65 | Westinghouse com. | 172 | 172 |
| Electric Vehicle | 15 | 15 | Westinghouse pfd. | .. | ... |
| Electric Vehicle pfd. | 20 | 21 | | | |

BOSTON

| | Jan. 2 | Jan. 9 | | Jan. 2 | Jan. 9 |
|---|---|---|---|---|---|
| American Tel. & Tel | 137⅛ | 136¼ | Mass. Elec. Ry. pfd. | .. | 63½ |
| Cumberland Telephone | ... | ... | Mexican Telephone | ... | ... |
| Edison Elec. Illum. | ... | ... | New England Telephone | 132 | 134½ |
| General Electric | ... | ... | Western Tel. & Tel. | 12 | 13 |
| Mass. Elec. Ry. | 17¾ | 18⅛ | Western Tel. & Tel. pfd. | 91½ | 94 |

PHILADELPHIA

| | Jan. 2 | Jan. 9 | | Jan. 2 | Jan. 9 |
|---|---|---|---|---|---|
| American Railways | 52 | 52 | Phila. Electric | 8¾ | 7⅝ |
| Elec. Co. of America | 11⅜ | 12 | Phila. Rapid Trans. | 30½ | 32 |
| Elec. Storage Battery | 80¼ | 82 | Phila. Traction | ... | ... |
| Elec. Storage Battery pfd. | .. | ... | | | |

CHICAGO

| | Jan. 2 | Jan. 9 | | Jan. 2 | Jan. 9 |
|---|---|---|---|---|---|
| Chicago City Ry. | 197¼ | 198 | National Carbon | 80 | 79 |
| Chicago Edison | ... | ... | National Carbon pfd. | 117 | 115 |
| Chicago Subway | ... | ... | Union Traction | .. | ... |
| Chicago Tel. Co | ... | ... | Union Traction pfd. | .. | ... |
| Metropolitan Elev. com. | 27 | 27 | | | |

DENVER GAS & ELECTRIC.—The Denver Gas & Electric Company has decided to retire all outstanding bonds other than its 5 per cent general mortgage 5s. The holders of underlying bonds will be offered cash for their bonds or they will be permitted to exchange them for the general mortgage 5s and a cash premium, which varies with the different underlying issues. This operation will make the general mortgage 5s an absolute first lien on all the property and assets of the company. The stockholders of the company of record January 20, 1906, will be given the right to subscribe for the general mortgage 5s issued to provide the cash premiums on the retired underlying bonds and for the purchase for cash of such as are not exchanged for general mortgage 5s and a cash premium. The price of the general mortgage 5s to the stockholders is 95 and interest, but the bonds will be pooled under an arrangement by which they may not be sold for less than par and interest for twelve months. The following bonds will be retired: Denver Gas & Electric 6 per cent, due 1910. This issue will be retired April, 1906, and holders have option of exchanging on or before February 1, 1906, for Denver Gas & Electric general mortgage 5s at par and 5 per cent cash. Western Electrical Construction 6 per cent, due 1915. This issue will be retired on April 4, 1906, and they may be exchanged before February 1, 1906, for general mortgage bonds at par and 7 per cent in cash. Denver Consolidated Gas 6 per cent, due 1911. These may be exchanged before February 1, 1906, at par and accrued interest for general mortgage 5s and 10 per cent in cash. Denver Gas & Electric prior lien 6 per cent. These may be exchanged before February 1, 1906, at par and interest for general mortgage 5s and 8 per cent in cash. Denver Gas & Electric 7 per cent collateral notes, due 1907. These may be exchanged before February 1, 1906, at par and accrued interest for general mortgage 5s and 8 per cent in cash.

ST. LOUIS LIGHTING.—Three-year collateral trust notes bearing 5 per cent. interest, totaling $4,000,000, have been issued by the Union Electric Light and Power Company of St. Louis, one of the subsidiary companies of the North American Company. The notes, which are placed on the market at 98, are secured by $4,000,000 of the stock of the Union Company. The North American Company pledges itself to purchase the stock at par upon the expiration of the notes. The returns will be used in improving the company's power plants. The collateral for the notes raises the issue stock of the Union Company to $8,000,000, out of an authorized capital stock of $10,000,000. The balance is still in the Treasury. In addition the company has a bonded indebtedness of $25,000,000. Mr. Patrick Calhoun, it is reported, will be elected president of the company. He is largely interested in the United Railways Investment Company. Mr. Frederick Brown will be given a place in the directorate and will undertake the improvement of certain of the company's properties.

NIAGARA POWER.—The New York State Gas and Electric Commission has received the application of the Niagara Falls Electrical Transmission Company for permission to increase its capital stock from $1,000,000 to $5,000,000 and to purchase certain obligations of the Albion Power Company and capital stock and obligations of the Niagara Falls Gas & Electric Light Company, and to pay off and retire its own bonds to the amount of $59,790. The Niagara Falls Electrical Transmission Company was organized for selling and distributing in the counties of Niagara, Erie, Orleans, Monroe and Genesee, current generated by the Electric Development Company of Ontario, Limited, a Canadian corporation. It is proposed to construct transmission lines sufficient in capacity for at least 50,000 electrical horse power. The capital stock is to be classified as $2,500,000 preferred and $2,500,000 common stock.

PITTSBURGH TROLLEYS.—A special meeting of the stockholders of the United Railways Investment Company, of San Francisco, has been called for January 31, to act on an increase in the company's common stock from $10,000,000 to $25,000,000. This new stock, it is said, is to be used partly for the purpose of acquiring a controlling interest in the Philadelphia Company of Pittsburgh, owner of the traction interests there, the negotiations for which were announced some time ago, and partly to provide funds with which to pay off the back dividends on the company's preferred stock. These dividends amount to about $900,000. The balance of the $15,000,000 new stock, after provision has been made for these two requirements, will be available for general corporate purposes.

AMERICAN LIGHT & TRACTION.—The executive committee of the American Light & Traction Company has increased the company's stock to the extent of 7,189 shares. Shareholders of record at the close of business January 10, 1906, will have the right to subscribe for the new stock to the amount of $1.25 par value of common stock and $3.75 par value of preferred stock for each share of their holdings of either common or preferred stock or both. The new stock will be offered at par ($100 per share), and will be issued in full shares only. All stock not subscribed for by stockholders by 3 o'clock on January 25, 1906, will be disposed of as the company's directors may determine. Subscriptions will be payable at the office of the president, 40 Wall Street, on February 5, 1906.

DIVIDENDS.—The Bell Telephone Company of Canada has declared a regular quarterly dividend of 2 per cent, payable January 15, 1906. The Pacific States Telephone & Telegraph Company has declared a regular dividend of 1¾ per cent. (quarterly), payable January 1. Directors of the West Pennsylvania Railways Company have declared a quarterly dividend of 1¼ per cent on the preferred stock, payable February 1. The directors of the Rocky Mountain Bell Telephone Company have declared a quarterly dividend of 1½ per cent, payable January 20, 1906. Books close January 10 and reopen January 20.

MANILA RAILROAD & LIGHT.—The operating department of J. G. White & Co., reports that the gross railway earnings of the Manila Electric Railroad & Light Company, Corporation, for the week ending December 14, 1905, were $11,100. The receipts for all departments for the month of November were as follows:

| | Gross. | Net. |
|---|---|---|
| Railway | $42,250 | $21,250 |
| Electric | 30,750 | 16,000 |
| Trucking | 2,250 | 451 |

KINGS COUNTY LIGHT.—The Kings County Electric Light & Power Company, of Brooklyn, N. Y., is to increase its capital stock by $3,200,000. The new stock will be offered to shareholders of record on January 15 in proportion to their holdings. At present the outstanding stock of the company amounts to $5,000,000. The proceeds derived from the sale of the new issue will be used for extensions and improvements of the company's properties. The company is doing an excellent business.

STANISLAUS POWER BONDS.—The new issue of $5,250,000 forty-year 5 per cent bonds of the Stanislaus Electric Power Company and $2,750,000 preferred stock of the Stanislaus Water Power Company, a holding corporation, have been underwritten by a New York syndicate managed by Tucker, Anthony & Company, F. L. Eldridge, of the Knickerbocker Trust Company, and C. C. Cuyler, of Cuyler, Morgan & Company. The securities were issued to secure a loan to finance an extension of the company's plant in California.

AMERICAN GRAPHOPHONE COMPANY, in its annual report, for year ended September 30, 1906, shows a total net income of $803,643, with charges and depreciation of $174,094; preferred dividends of $117,210 and common stock dividends of $54,067. The surplus carried forward for the new fiscal year is $1,027,854 as against $729,481. Dividend payments are on a conservative basis. The company is earning 16 per cent on its entire capital stock and is paying dividends of less than 5 per cent.

MAINE TELEGRAPH COMPANY.—The stock of the Maine Telegraph Company was transferred at Bangor, Me., on January 5, to the Western Union Telegraph Company, 2,221 shares being transferred at $57.50 a share, the par value being $50. The Maine Telegraph Company has been under lease to the Western Union Company fifty years, the lease having just expired.

DAVENPORT, IA., CONSOLIDATION.—St. Louis and New York capitalists are negotiating to form a $10,000,000 consolidation of gas, electric light, power and traction interests, of Davenport, Rock Island and Moline, a community of 100,000. Mr. George Kobusch is engineering the merger. The Mississippi Valley & Commonwealth Trust Company, of St. Louis, is assisting. It is understood that the plans are practically complete.

UNION SWITCH AND SIGNAL.—Union Switch & Signal stockholders of record have the right to subscribe on or before January 25, at $75 per share (par $50) for new stock to the extent of 12½ per cent. of their respective holdings.

KEYSTONE TELEPHONE.—There has been listed on the Philadelphia Stock Exchange $4,000,000 first mortgage 5 per cent 30-year gold bonds of the Keystone Telephone Company of Philadelphia due July 1, 1935.

MILWAUKEE ELECTRIC.—The Milwaukee Electric Railway & Light Company shows for November a net total income of $150,903, an eleven months net of $1,534,886 and a surplus after charges of $686,961.

# General News.

SAN FRANCISCO, CAL.—An interruption of the supply of current at the sub-station at Kennett, Shasta County, caused the Mammoth smelter to close down recently, allowing the furnaces to "freeze." The town was left without lights, which are ordinarily supplied by the Northern California Power Company.

SAN FRANCISCO, CAL.—The General Electric Power Company, of California, has filed a certificate with the county clerk, announcing that it has voted to create a bonded indebtedness of $7,500,000. The certificate is signed by the directors, Kent J. C. Seymour, Guy C. Calden, W. E. Cashman, Harry C. Allen, Albert H. Elliott and Joseph P. Lucey.

BRIDGEPORT, CONN.—The Challenge Cutlery Co., Bridgeport, Conn., has finished the installation of a 250-horse-power electric plant, with a direct-connected engine and motors in each department.

WOODBURY, CONN.—The Woodbury Electric Company has just made provision against a scant water supply by installing a new boiler and engine to furnish the necessary power when the water is low.

ROCKVILLE, CONN.—The new mayor of the city, Mr. G. Forster, has come out with a strong plea for municipal ownership in his message, which includes a sneer at his predecessor as being in the service of the local lighting company.

ATLANTA, GA.—City Electrician Fred Miles, in his annual report, states that during the past year 76 new arc lights and 19 series incandescent lights have been installed, making the total number now in use 981 arc lamps and 462 series. Two complete tests of the street lights were made during the year, results showing a very efficient service. His report on interior wiring showed new installations of 35,304 incandescent lamps, 203 electric fans, 297 arc lights and 111 motors. Mr. Miles also recommended that some action be taken looking to the separation of telephone and high-voltage wires.

EAST ST. LOUIS, ILL.—At the East St. Louis City Council meeting Mayor Silas Cook was authorized to have an ordinance drawn up annulling the franchise of the Illinois Illuminating Company. This company was granted a franchise over the streets two years ago, and has tried to hold the privilege by keeping five arc lamps lighted in various parts of the city.

FREEPORT, ILL.—William Waterstadt, city clerk, writes that the contract for lighting the city for five years has been awarded to the Freeport Railway, Light & Power Company at the following bid: 125 to 149 lights at $70 per year; 140 to 174 lights at $67 per year, and 175 to 200 lights at $64 per year; 50 to 74 60-cp. incandescent lights at $26 per year, and 75 to 100 at $25.50 per year.

SCAMMON, KAN.—W. Milburne, of Jackson, Tenn., is constructing a $100,000 electric light plant in this city.

RICHMOND, KY.—Mr. H. M. Case, an electrician of Cleveland, Ohio, has been appointed superintendent of the Richmond Electric & Power Company and has already entered upon his new duties.

PALMER, MASS.—At a recent meeting of the directors of the Central Massachusetts Electric Company the following officers were elected: President, Charles E. Fisk; vice-president, G. C. Flynt; executive committee, G. C. Flynt, A. W. Paige, M. J. Warner; superintendent, F. N. Carpenter.

WEST SPRINGFIELD, MASS.—The United Electric Light Company will supply the town on the same terms as hitherto, by runninng on the two years' option, which was one of the clauses of the old contract, and which will run nearly to the end of 1906. The Selectmen desired to make a new five years' contract, but this did not go through at the town meeting.

WEST SPRINGFIELD, MASS.—The electric lighting tangle at West Springfield is somewhat cleared through the signifying on the part of the officials of the United Electric Light Company, of Springfield, that the company will be willing to make a lighting contract with West Springfield which will expire when the contract now in force with Springfield expires. This contract will expire in May, 1909. One of the arguments brought up in the West Springfield question was that if a contract was made for five years it was possible that Springfield might make better rates at the time of her renewal and that thus West Springfield would for a year or more by paying higher rates than necessary. Manager Walter Mulligan has stated that the United Electric Light Company was perfectly willing to make a contract for less than five years, to expire when the Springfield contract does.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston, continues to report a steady growth of business, with the result that it is said there will be no issue of new stock this year. The company's operations in Newton and Watertown have been extended, a sub-station for that purpose having been erected on Massachusetts Avenue, in Newton. The property of the Medway Electric Light Company, operating in Medway and Bellingham, was recently taken over, and within the next few days the Medfield Electric Light & Power Company, which supplied the Medway Company with power, will also be taken over by and merged with the Edison company. The Medfield company, in addition to supplying power to Medway and Bellingham, has operated in the towns of Sharon, Medfield, Walpole, Norfolk and Millis. Another contract which the Edison company is about to execute is one for seven years with the town of Wellesley, providing for supplying that locality with all the power required for municipal and commercial lighting. All told, the Edison is now supplying power over more than 400 miles of territory, including a population of almost 900,000.

PORT GIBSON, MISS.—At a recent special meeting of the Board of Aldermen Mr. Hershell Brownlee was appointed superintendent of the Port Gibson electric light and water works, to succeed Joseph E. Craig, resigned.

ST. LOUIS, MO.—Thomas B. Carter, supervisor of city lighting, has prepared a report showing what his department accomplished during the calendar year ending December 31. During 1905, the reports shows, St. Louis expended $407,708.20 to light its streets—$109,761.09 for electric lamps in the business district and $387,947.11 for mantle gas lamps in the residence sections. These figures are for that portion of the city north of Keokuk Street. For street lighting south of that thoroughfare, maintained under a separate contract, the city paid $44,868.87 for mantle lamps. Under the contract for lighting public buildings north of Keokuk Street in 1905 the city paid $20,544.04 for electricity and $442.50 for gas, a total of $20,986.54; south of Keokuk Street, $547.09 for electricity and $5,448 for gas, a total of $5,995.09. The cost of gas used for fuel in buildings used by the city was $2,226.70. Among the items of the report are the following: Electric lamps erected, 29; building lights installed, 847; number of poles erected: telephone, 2,736; electric light, 1,359; street railway, 65. Trench-feet of conduit constructed: Telephone, 57,600; telegraph, 13,060; electric light, 25,775. Total number of lights: Electric arc, 1,000; electric incandescent, 800; mantle, 18,000; in public buildings, 10,000.

MEREDITH, N. H.—The electric light line from Laconia to this place is now completed, and power for the Meredith street light service is supplied from the power station of the Laconia company at Lakeport. The Laconia Electric Lighting Company purchased the Meredith plant sometime since, and now that the new line has been completed the latter will probably be abandoned.

NEW HAMPTON, N. H.—The annual meeting of the New Hampton Electric Light & Power Company has been held and the following officers elected: President, George A. Emerson; vice-president, M. H. Merrow; secretary and treasurer, C. D. Thyng; directors, George A. Emerson, M. H. Merrow, I. E. Gray, A. S. Bronson, F. P. Morrill, Carrie R. Morrill, Marshall Ballou; general manager, C. D. Thyng. It was voted to pay a dividend of 5 per cent this year; no dividend was paid last year.

OGDENSBURG, N. Y.—Plans are being perfected for the development of power at the falls in Trent River for the operation of an electric railway along the St. Lawrence and Lake Ontario from Cornwall to Toronto, as well as a projected road from Brockville to Ottawa.

NEW YORK CITY.—The American Light & Traction Company has purchased the properties of the Lacomb Electric Company, of Denver, Col., and the Muskegon Traction and Light Company, of Muskegon, Mich. The system of the latter property consists of gas and electric light plants and a street railway system.

PASSAIC, N. J.—The Public Service Corporation is reported to have secured the contract for lighting the city for five years at $85 per light per year for arc lights, $15 per year for incandescent lights, $17 per year for street gas lighting, 10c. per kw-hour for public building incandescent service, $1 per 1000 cubic feet for gas, and 13c. per kw-hour gross for private incandescent service.

COLUMBUS, OHIO.—The Cincinnati Gas & Electric Company has filed an amendment to its charter with the Department of State to cover the natural gas phase brought about by the franchise granted by the City Council a few days ago.

MECHANICSBURG, PA.—The secretary of the Town Council has been authorized to receive bids until January 20 for lighting the borough with electricity during the year beginning July 1, 1906. At present there are in use 48 arc lights and 35 incandescent lights.

PHILADELPHIA, PA.—Mayor Weaver is beginning to talk about $60 a year as a possible price for city lights next year, and says: "I believe if a new corporation were formed in this city to compete with the present company the expense of public and private lighting could be reduced by almost one-half and yet have a handsome profit for the corporation."

ROCK HILL, S. C.—The Carolina Water Power Company, controlling water and light franchises in Florence, Darlington and Marion, has absorbed the Rock Hill Water, Light & Power Company and taken possession of its plant. Messrs. R. T. Fewell and J. M. Cherry, formerly the largest stockholders, retain a small interest in the property. Mr. S. T. Frew, who has been the manager here for the company, will go to Florence with the new concern.

MILWAUKEE, WIS.—The joint committee on street lights and judiciary has decided to recommend to the Common Council the making of a contract with the Milwaukee Electric Railway & Light Company for five years at $65.00 per lamp per year.

WENATCHEE, WASH.—The City Council at its last meeting granted Arthur Gunn, manager of the Wenatchee Electric Company, a new franchise, to expire January 1, 1950. The franchise formerly held contained a clause giving the city an option to buy the plant in 1915 at its appraised value. The new franchise is identical with the old one, except for the elimination of the clause specified and that the city has been given a reduction of 25 per cent in the price of light furnished it by the company.

VANCOUVER, B. C.—The British Columbia Electric Street Railway Company has secured the contract to light the city for $38 per arc light per year for a period of ten years from June 10 next. The city has heretofore paid $90 per light. The agreement stipulates that the number of lamps shall not be less than 400. The lamps are to take 7.5 amperes at 60 cycles, consuming 48 volts at the lamp terminals. All lamps are to burn every night all night throughout the year. The City reserves the right to establish at any time its own plant for lighting the city streets and public buildings upon furnishing a one year's notice in writing to the company.

# Construction News.

MOBILE, ALA.—Contract has been awarded to E. J. Fike for the construction of a fireproof two-story and basement structure for the Home Telephone Company, to be used as an exchange, on South Conception Street.

GADSDEN, ALA.—Articles of incorporation have been filed by the Coosa River Electric Power Company, with a capital of $100,000. Officers have been elected as follows: President, Robert D. Johnson; vice-president, R. H. Cobb, of Anniston; secretary and treasurer, Henry K. White; engineer and general manager, Robert R. Zell, of Birmingham. The intention of the company is to build a dam and electric power plant at Ten Island Shoals, at the point where the Seaboard Air Line crosses the Coosa River. This power will be transmitted to Anniston, 14 miles distant, to Gadsden and other points. The dam will be constructed of reinforced steel and concrete and will be 600 feet long by 22 feet high. The company has opened an office in the National Bank Building, Birmingham.

SAN BERNARDINO, CAL.—C. M. Graw, general manager of the San Bernardino Gas & Electric Company, writes that it is proposed to rebuild at once the power plant recently burned.

LOS ANGELES, CAL.—The Board of Supervisors has been asked to grant a franchise for an electric railway to begin at Maubert Avenue and run to a point in the Los Feliz Road, there connecting with the Mount Hollywood incline railway.

LOS ANGELES, CAL.—Right of way has been given by the McCarthy Company to the Los Angeles Railway Company for a crosstown line in the southwestern part of the city along 54th Street and connecting the Rodondo line of the Los Angeles & Rodondo Railway Company with the Maple Avenue line of the Los Angeles Railway Company.

SAN FRANCISCO, CAL.—The Petaluma & Santa Rosa Railway Company's surveyors have run lines for an extension from Santa Rosa to Healdsburg through Dry Creek Valley. This and several other branch lines will be completed during 1906. It is expected that a new line running south to connect Petaluma with San Francisco Bay points will be decided upon in the near future.

SAN DIEGO, CAL.—It is announced that the San Diego Electric Railway, one of the Speckels properties here, will be extended to La Jolla, a well-known summer resort on the ocean front, about 14 miles north of the city. The extension will be from Old Town, to which place the company is preparing to build. A narrow-gauge steam road now connects the two places, but it is desired to give the people a fast electric car service.

FLORENCE, COL.—The City Council has voted to grant to F. S. Granger the San Diego capitalist, a 20-year franchise to maintain and operate a street railway system in this city.

LEADVILLE, COL.—Col. James A. Shinn, of Leadville, says he has been in communication with the Westinghouse Electric Company regarding a plan to build an electric railway to connect Leadville with Twin Lake and the Horshoe District.

FLORENCE, COL.—Thomas Robinson, president of the Florence Electric Street Railway Company, says that his company is about ready to commence construction of the first 21 miles of the proposed line. The road will do a passenger, express and freight business, and will run from Florence to Canon City, the outlying coal camps and the Portland Cement Works. It will be built on the most modern methods and will cost about $500,000.

ROCKVILLE, CONN.—In the Mayor's annual message attention was called to the need of an improved lighting service and the recommendation of the municipal ownership of the gas and electric lighting plants, if necessary, to obtain this result.

RIDGEFIELD, CONN.—The Ridgefield Electric Company is preparing to construct a new power house of reinforced concrete. The building will be 70 x 24 and 20 ft. high, divided into engine and boiler rooms by concrete partitions. The mechanical and electrical equipment has been contracted for, and it is expected that the plant will be in operation in the early summer.

NAUGATUCK, CONN.—The Naugatuck Valley Electric Railway Company, which is to build an electric railway from Naugatuck south through the Naugatuck Valley to Beacon Falls and thence to Seymour, has acquired the last piece of land which is needed as a right of way in Naugatuck. The work of clearing the land for the roadbed has begun and structural operations will now be pushed.

SUFFIELD, CONN.—The Consolidated Railway Company has under consideration the advisability of changing the power house of the village water company at Suffield from a complete generating station to a sub-station. The proposed change involves a high-tension line from the power house of the Springfield Street Railway Company to the Suffield Company's power house, and the installation of a rotary converter at the Suffield end.

WILMINGTON, DEL.—President U. G. Glick, of the Kent County & Delaware Bay Traction Company, is becoming active in the preliminaries for the construction of the proposed electric railway in Kent County. As soon as the machinery is shipped and the construction equipment arrives Mr. Glick says they will positively begin work, and will not only construct the line from Smyrna to Woodland Beach, but will build from Smyrna to Dover. The traction company may also purchase the Smyrna electric lighting plant.

TAMPA, FLA.—The Tampa Electric Company has a force at work preparing to extend the lines of the company from Lafayette Street, near the bridge, to the power house.

JACKSONVILLE, FLA.—George W. Clark, who recently purchased Panama Park, is reported to have under consideration plans for building an electric railway from Bay Street, Jacksonville, through Springfield, touching at Woodlawn Cemetery and extending to Panama Park.

WAYCROSS, GA.—The Waycross Electric Light & Power Company, C. W. Sexton, superintendent, is going to change and remodel its electric plant, and will be in the market for new machinery.

MARIETTA, GA.—The Georgia Manufacturing & Public Service Company has been organized here, with Moultrie M. Sessions, president, and William Burckel, secretary, to take over the water works, electric light plant and paper mills. It is proposed to expend about $25,000 in enlarging the water works, installing a filter plant and completing the paper mill. J. H. Wallace, New York City, has been selected as consulting engineer in charge of the proposed work.

SCOTTSBURG, ILL.—The Scottsburg Telephone Company has been incorporated with a capital of $1,200, by O. T. Hoyt, O. M. McElvain and C. R. Paul.

VICTORIA, ILL.—Amel Harms has taken up the matter of establishing an electric light plant here and it is believed that the project will be successfully carried through.

DONGOLA, ILL.—The Dongola Home Mutual Telephone Company has filed articles of incorporation. B. F. Crabtree, Thomas R. Baugh and J. F. Karraker are the interested parties. The capital is stated to be $2,500.

GRANITE CITY, ILL.—The Kinloch Telephone Company is to erect a new exchange at Granite City, Ill., and St. Louis, and local capitalists have been in conference as to the organization of a local company to conduct the business.

FREEPORT, ILL.—The Freeport Railway, Light & Power Company is about to develop another water power on the Picatonica River, about five miles below Freeport, to operate in conjunction with the company's present water and steam plant at Freeport.

WAUKEGAN, ILL.—The North Shore Electric Company, which has already spent $50,000 for a site for its power plant, is making preparations to spend half a million more in the erection and equipment of the plant itself, which is to be completed within the year.

EDWARDSVILLE, ILL.—At a special meeting of the City Council January 4, a franchise was granted the McKinley Traction Company, to construct and operate a gas and heating plant and an electric light plant. The duration of the ordinance is fifty years and the McKinley Company is to assume the contract of the Edwardsville Electric Light plant, which at present furnishes light for the city. The contracts now in force have about four years to run, when a new schedule will be prepared. The transfer will be made within ten days.

JACKSONVILLE, ILL.—The Jacksonville Railway & Light Company was recently incorporated under the laws of Maine with $500,000 authorized capital stock, as a consolidation of the Jacksonville Railway Company and the Jacksonville Gas, Light & Coke Company. The details of the bond issue of the new company have not yet been arranged, but it is proposed to retire the bonds of the old company as fast as they can be taken up. The officers of the company are: President, W. B. McKinley; vice-president and manager, L. E. Fischer; secretary and treasurer, G. M. Mattis.

CANNELTON, IND.—Fire has partially wrecked the city's electric light plant, entailing a loss of $2,300.

NEW CARLISLE, IND.—George Cadogan Morgan, 808 Royal Insurance Building, Chicago, Ill., is designing and consulting engineer for an electric power plant to be constructed at this place.

FORT WAYNE, IND.—Engineer L. P. Huntoon, of this city, is assisting in the survey of the new traction line from St. Marys to Defiance, Ohio. Fort Wayne capitalists are said to be interested in the road.

CANNELTON, IND.—The city electric light, heat and power plant has been destroyed by fire, and it is reported that bids will be received at once by the City Auditor for rebuilding the plant.

SEYMOUR, IND.—The Indianapolis, Columbus & Southern Traction Company and the Louisville & Indianapolis Traction Company have asked for a franchise to enter this city. The former will build new car barns here and the latter will build an east and west line to connect Brownstown and North Vernon.

PERU, IND.—The City Council has granted a franchise to the Winona Interurban Company to use and lay tracks on Broadway. This action grew out of the refusal of the Indiana Union Traction Company to permit the Winona Company the use of its tracks in Broadway. The latter company will now begin the construction of a line from Peru to Warsaw, and the Union Traction Company will build from Wabash to Warsaw.

INDIANAPOLIS, IND.—The Capital Circuit Traction Company has been incorporated with a capital of $10,000. The promoters propose to build an electric railway between Danville, Lebanon, Greensburg, Martinsville, Noblesville, Franklin and Shelbyville, connecting these towns, all of which are touched by interurbans out of Indianapolis. Charles E. Overill, James N. Crabb and others are among the incorporators.

OSCEOLA, IA.—Plans are being discussed for the construction of an interurban road from this city to Des Moines, via Liberty Center.

ELLIOTT, IA.—Lester Malony is undertaking to organize a stock company with a capital of $2,000, to construct and operate an electric light plant in this city.

SCOTT CITY, KAN.—The City Council has granted to J. B. Loughran and H. E. Nicholson, a 21-year franchise to construct and operate an electric light plant in Scott City.

COLUMBUS, IND.—The City Council has authorized Mayor McCormack to take the necessary steps for the construction of a municipal electric light plant.

KANSAS CITY, KAN.—The City Council has adopted a resolution asking the Metropolitan Street Railway Company to build a double-track street railway on Thirteenth Street between Minnesota and Stewart Avenues.

ARKANSAS CITY, KAN.—The proposition to issue $22,000 bonds for the aid of the Kansas-Oklahoma Interurban Railroad has carried by a large majority. The road is to extend from Chilocco, O. T., to Arkansas City and thence to Winfield, with street car systems in the two towns. Later the road will be extended to Geuda Springs and may connect with the proposed line from Newkirk, O. T., to Guthrie.

LOUISVILLE, KY.—The Cumberland Telephone Company is to spend $525,000 immediately on improvements, and at Nashville, Tenn., will erect a new $75,000 plant.

BUCKFIELD, ME.—Preliminary steps have been taken to install an electric light plant in the machine shop of Arlington Damon for supplying lights to the village.

WATERVILLE, ME.—Plans are before the Railroad Commissioners for the extension of the Portland & Brunswick Electric Railway through Freeport, Cumberland and Yarmouth.

DEXTER, ME.—Henry P. Dexter, architect, is at work upon plans for the new power house to be erected near the Maine Central station by the Dexter Electric Company for furnishing power to operate the electric lights of this village. As soon as the plans are completed they will be submitted to local contractors for bids on the construction.

PRESQUE ISLE, ME.—The Maine & New Brunswick Electrical Power Company, Ltd., which is promoting the development of Aroostook Falls, has secured a Canadian charter to distribute and sell electric power in the counties of Victoria, Carleton and Madawaska and other localities adjacent thereto. The Maine charter gives the company the same rights in the towns of Fort Fairfield, Presque Isle, Limestone, Easton, Mars Hill, Blaine, Bridgewater, Monticello, Littletown and Houlton. The company recently purchased the plant of the Presque Isle Electric Light Company and now owns all the land on both sides of the Aroostook River at the Aroostook Falls, controlling thereby all necessary riparian rights for the development of water power. The plant will have an initial capacity of about 1,000 horse-power, to be increased later to 2,000 horse-power, part of which has been contracted for by the Aroostook Valley Railroad Company. The latter concern has made surveys and filed plans for the construction of 16 miles of road between Presque Isle and Washburn, which will be built as soon as this plant is completed and ready to furnish the power for operating the road. The company is capitalized at $250,000. Its officers are: N. M. Jones, president; L. G. Crosby, treasurer; James D. Seeley, secretary; A. R. Gould, managing director; Hon. H. M. Heath and Hon. William Pugsley, corporation counsel.

BALTIMORE, MD.—It is stated that the Municipal Lighting Commission, consisting of Edwin J. Baetjer, Subway Engineer Phelps and City Engineer Fendall, proposes investigating the city lighting conditions, and will report on the feasibility of establishing a municipal plant. If such a plant is recommended there is a loan of $1,350,000, which only needs the approval of the City Council and the ratification of the people to become available.

PITTSFIELD, MASS.—Plans are being prepared for the new power plant of the Pittsfield Street Railway Company, which is soon to be erected in this city.

HADLEY, MASS.—The contract for the building of the new substation power house to be built by the Connecticut Valley Street Railway Company, at Hadley, has been awarded to former Mayor John L. Mahter, of this city.

WORCESTER, MASS.—A petition looking towards the development of the idle water power in Massachusetts will be presented to local residents for signatures through President Lonergan, of the Merchants' Association, within a short time.

BALDWINVILLE, MASS.—Herbert G. Lowell, of East Templeton, is soliciting business for electric light, claiming that if he can obtain subscribers for 2,000 lights a Providence company stands ready to install an electric lighting plant here and have it in operation by September 1, next.

WESTFIELD, MASS.—Manager Pettibone, of the municipal electric light and power plant, is figuring on installing additional equipment that will materially increase the output of the plant. This has been made necessary by the increased demands for power from manufacturing concerns.

NEWBURYPORT, MASS.—An order has been introduced by Councilman Morrison to appoint a committee consisting of two councilmen and one alderman to be instructed to confer with the Gas & Electric Company, to find out the cost of all-night street lighting and to report back at the next meeting.

HOLYOKE, MASS.—The Gas and Electric Department has had added to it a 500-kw steam turbine which when contracted for was considered ample provision for three or four years to come. So fast, however, has the volume of business increased that the city must this year install another turbine.

LOWELL, MASS.—At a meeting of the Board of Aldermen an order providing for a municipal gas and electric plant for lighting and heating was introduced by Alderman Carmichael. He hoped this one would be acted upon at once. The city had had enough of free franchises to companies. The order was unanimously adopted.

BOSTON, MASS.—The Massachusetts Interurban Street Railway Company, with a capital of $5,000,000, is seeking incorporation. The company proposes to build a high-speed street railway from Boston to Fall River and New Bedford and Providence. The incorporators include Thomas J. Milvahill, Daniel J. Toomey, John J. McNamara, James J. Connelly, Bernard J. McCarron, William S. Haverty and James T. Cox.

FALL RIVER, MASS.—The Old Colony, Dartmouth & Westport and the Providence & Fall River Street Railway companies have been given franchises to run cars through the city for baggage and light freight. The petition of the Old Colony Street Railway Company for permission to extend its tracks to connect with the Enterprise Transportation Company's line of steamers to New York has been referred to the new city government.

LEOMINSTER, MASS.—The Selectmenn and the officials of the Leominster Electric Light, Power & Heating Company have come to an understanding regarding the street lights of the town and both parties agree that the lights at the present time are in a most deplorable condiion. There is, however, a disposition on the part of the company to give the town just as good lights as money can provide and all they need is time to get them installed.

MARLBORO, MASS.—It is announced that the Marlboro Electric Light Company will hereafter furnish a 24-hour service, including Sundays and holidays. The company will add largely to the equipment of its plant on Florence Street, and the fixtures in use about the city will be replaced with new ones. With the continuous service the company will be enabled to install lamps and furnish lighting for vaults, closets and such places, and a complete line of cooking utensils and household appliances will be carried at the company's office.

AMESBURY, MASS.—It is understood that the new stockholder of the local electric light company, who has secured a controlling interest, has requested that the present directors and management remain in control of the affairs of the company. It is said to be his desire that a large amount of new bonds be issued to take care of the floating indebtedness and secure enough funds to make large and extensive repairs to the plant. Among these latter are the purchasing of new machinery and the placing of all machinery upon one floor.

PITTSFIELD, MASS.—Referring to electric lighting, the Mayor in his address says: "Our contract for street lights will expire early in 1907 and it may be wise to take the matter up during this year. I had hoped to be able to make some definite recommendation regarding this matter, but find it a subject where figures would be of no value at this time, for while one set of figures would be of use in some other city they would be useless here. I would recommend that when a new contract is considered the moonlight system be discontinued; that an all-night system be seriously considered and that many lamps that are now obstructed by the foliage be relocated.

PITTSFIELD, MASS.—The Stanley-G. I. Electric Company during 1905 nearly doubled its working force, having at the first of 1905, 866 persons on its payroll and now there are 1400. In addition to increasing the working force, new buildings of the saw-tooth variety have been erected and a few extensions to other buildings have been made. These additions cost about $25,000 and their floor space is approximately 30,000 square feet. During the coming year the company plans to put up a number of new buildings, although their erection is dependent upon the grants and privileges allowed the company by the city. Even though these buildings do not go up, it is expected that 200 or 300 new employes will be added.

NEW MARLBORO, MASS.—H. K. Bloodgood, of New York City, who has a 2,000-acre estate in New Marlboro, and who is building a handsome residence here, has just bought, through Frank H. Wright, of Great Barrington, three water-power privileges on the Konkapot River, at this point. The three properties will develop a total of 250 horsepower. Mr. Bloodgood proposes to develop enough power to light his house and grounds, which will require 500 lights, and also furnish light for the town. Mr. Bloodgood is also interested in the project to build an electric railway from New Marlboro to Great Barrington, a distance of nine miles, and it is probable that part of the power generated at the proposed plant will be furnished to operate this line.

PITTSFIELD, MASS.—Architect and Engineer C. K. Stearns, of Boston, who prepared the plans for the power plants of the Berkshire Street Railway Company, will shortly complete plans for the new power house of the Pittsfield Street Railway Company. As soon as the plans are ready they will be offered to the contractors for figures. Should the open winter continue, the plant would be started at once, as the company is desirous of completing it at the earliest possible date. If the weather prevents building at this season the work will be started as early as possible in the spring. The plant will be of the most modern construction throughout. The company has decided to generate its own power and has given up the idea of purchasing power from several companies.

HOLYOKE, MASS.—Manager W. H. Snow, of the City Gas and Electric Department, has filed his third annual report, in which he calls attention to the increasing volume of business transacted from the gas works and electric plant. From the former there has been sold 13,103,300 cubic feet more gas than during 1904, an increase of 12.6 per cent; while from the latter, there is being sent out about 40 per cent more power than at this time a year ago. During the year, at the station, there have been installed one 500-kw turbo-generator with ample condensing apparatus and three 300-hp boilers, practically doubling the steam capacity of the plant. The plant, at the rated capacity of the generators, is now equipped to furnish 2,200 electrical horsepower with water and steam power run together; but it can furnish only 1,733 electrical horsepower with steam power alone. When the turbo-generator was purchased last winter, it was

thought that the equipment would be large enough to take care of the growth of the business for some years, but the station has already almost reached the limit of its capacity, it being able to take on only about 20 per cent more business with its combined water and steam power, and has reached the rated capacity of the steam plant. During the past fall, the four remaining mill powers of the 16, appurtenant to the plant, were taken; but the business has increased so much, that some steam power has to be used every day in addition to the water power, as the water wheels do not furnish power enough for the daylight load alone. Mr. Snow recommended that the department be given the necessary authority to add to the equipment at the station one 1,000-kw, or 1,333-hp unit, including the steam power and electric generators. He also called attention to the lack of adequate coal storage facilities in case the output of the plant is increased and stated that in order to be in a postion to handle whatever demand for power that may come, a sufficient lot of land conveniently situated as to railroad facilities and the station should be acquired to give storage ample for a winter's supply of coal, recommending that the department be authorized to purchase such a lot of land.

DETROIT, MICH.—The Common Council has adopted resolutions requesting Commissioners of Works and Parks to include in their estimates appropriations sufficient to construct a trackless trolley system around Belle Isle and over the bridge. It is estimated that the entire equipment, including cars, overhead construction and power house, will cost about $52,000. When the commissioners of the two departments have submitted their estimates, the appropriations will come regularly before the Council again and then to the Board of Estimates.

MUSKEGON, MICH.—Muskegon Heights will shortly have an electric light plant, to be erected at a cost of $15,000, and water works which will cost $35,000, if the action of the City Council is sustained by the citizens at a special election to be held January 29.

ANN ARBOR, MICH.—The latest reports concerning the electric railway between Ann Arbor and Toledo are to the effect that A. S. Foster, of the latter city, has been securing extensions of franchises and options on right of way for the proposed extension of this line from Petersburg to Britton, Ridgeway and other towns.

KALAMAZOO, MICH.—At a recent meeting of the directors of the Kalamazoo, Elkhart & South Bend Railroad, it was announced that the organization had been incorporated in both Michigan and Indiana. The capital of the concern is placed at $55,000. The following officers were elected: A. D. Harris, president; H. C. Morgan, vice-president; Edward C. Vincent, secretary; Adam Hunsberger, treasurer; John A. Bowman, auditor. Mr. Vincent states that this company was organized to carry on the work started by another company about two years ago. The company has taken over all the old franchises and proposes to push the enterprise through. The line when completed will run from Kalamazoo to Vicksburg, thence to Parkville and Three Rivers, Constantine, Mottville, Union, Elkhart and South Bend. The road is intended to be a connecting link between lines diverting to points in Michigan from Kalamazoo and from South Bend to points in Indiana. It will be built upon a private right of way and a force of engineers will at once begin the surveys.

MINNEAPOLIS, MINN.—Plans are being perfected for additional development of 6,000 horse-power at St. Anthony Falls. The Pillsbury-Washburn Company, which controls the power, will make the development and market the power. The work will be in charge of William de la Barre, chief engineer of the St. Anthony Falls Water Power Company. The site for the new power station has not been selected as yet. It is proposed to utilize the water that has been going to waste over the falls. It is stated that the market for the addiional power is practically assured in plans that are under way for the establishment of one or more large industries and in contracts for certain amounts as soon as the development is completed.

HATTIESBURG, MISS.—Business men of Hattiesburg have bought the interest of the Meridian men in the proposed Hattiesburg Gas & Electric Railway Company. According to the terms of the franchise, three miles of the road must be in operation by June 1.

NEWTON, MISS.—Kirkpatrick & Johnson, of Jackson, are preparing plans for enlarging the electric light plant. A new direct-current outfit will be installed and additional pole lines will be constructed.

MISSOULA, MONT.—Senator W. A. Clark is reported to have purchased the plant of the Missoula Light & Water Company. It is stated that it is proposed to construct irrigation ditches; also a new electric railway, and to complete the dam at Bonner.

BURLINGTON JUNCTION, MO.—Henry Williams is said to be interested in the construction of a local electric light plant.

CAMDEN, N. J.—The City Council has requested the City Solicitor to inform the Council what legal steps are necessary for the establishment of an efficient municipal lighting plant before the expiration of the present lighting contract, and the probable cost of such a plant.

PLEASANTVILLE, N. J.—The Atlantic City & Suburban Trolley Company will double track its line across the meadows and make other improvements.

BUFFALO, N. Y.—The franchise granting the International Railway Company the right to lay 6½ miles of double track in Fillmore Avenue was signed by Mayor Knight, December 29.

NEW YORK, N. Y.—The New York Telephone Company will build on Gold Street, an eight-story brick exchange building, to cost $50,000 in construction. Eidlitz & McKenzie, 1123 Broadway, are the architects.

BROOKLYN, N. Y.—A railway company is said to be in process of organization for the purpose of bidding for the franchise of the routes laid out by the Rapid Transit Commission on the west and east sides of Manhattan and Brooklyn.

ITHACA, N. Y.—The survey has been completed for the Ithaca & Horseheads Electric Railway. The line as drawn will extend between Ithaca and Elmira, passing through Enfield Falls, Mecklenburg, Odessa and Horseheads. J. L. Marshall, prominent in the affairs of Ithaca, is interested in the company.

ALBANY, N. Y.—The Niagara Falls Electrical Transmission Company has made application for permission to increase its capital stock from $1,000,000 to $5,000,000; also to purchase certain obligations of the Albion Power Company and the capital stock, etc., of the Niagara Falls Gas & Electric Light Company.

BINGHAMTON, N. Y.—President G. Tracy Rogers, of the Binghamton Railway Company, is reported to be negotiating with the Ontario Power Company, of Niagara Falls, N. Y., for supplying power to the Binghamton Company. The power line to Binghamton would come by way of Watkins, Corning, Elmira, Waverly and Endicott.

TROY, N. Y.—N. R. Holmes, of Troy, attorney for the Ticonderoga Light & Power Company, writes that the proposed plant will cost about $50,000 and that bids for the construction will be received in about 30 days. F. B. Gridley and N. R. Holmes, of Troy, and F. T. Locke and A. B. Adkins, of Ticonderoga, are also interested.

DAYTON, OHIO.—The Dayton Citizens' Electric Company has been incorporated with a capital of $100,000 by Cyrus E. Mead, F. T. Griest, H. B. Arnold and others.

WOOSTER, OHIO.—Pugh & Hubbard, Real Estate Building, Philadelphia, Pa., are making surveys for an electric railway from Wooster to Mansfield, a distance of 40 miles. Work will be begun in the spring.

NILES, OHIO.—Bids will be received until January 24 at the office of B. L. Hogan, City Auditor, for $4,000 bonds, the proceeds of which will be used for enlarging, repairing and equipping the electric light plant.

CINCINNATI, OHIO.—According to reports, this city is to have a new power plant, to be erected at the southeast corner of Pendleton and Danridge Streets. The improvements, together with the land, will, it is estimated, cost $300,000.

MARYSVILLE, OHIO.—Articles of incorporation have been filed for the Union County Telephone Company by N. E. Liggett, Wallis C. Fullington, W. O. Shearer, George P. Whitney and H. E. Courtright. The company is capitalized for $200,000.

CAMBRIDGE, OHIO.—The Consolidated Company, which operates a road from Cambridge to Byesville, is planning to extend the line to Pleasant City, Derwent and Buffalo, and possibly to Caldwell. The property is owned by the Cameron Company of Marietta.

DELAWARE, OHIO.—The Richwood & Magnetic Springs Railway Company has been organized. It is being promoted by the same interests that own the Delaware & Magnetic Springs Railway now operating to Magnetic Springs from Delaware. W. M. Galbraith, of Pittsburg, is at the head of the company.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company, it is stated, has secured the contract to supply arc lights to the city during the year 1906 at $69.72 per lamp. Director Springborn has decided to ask the Council for $10,000 with which to purchase poles and wires so that extension plans can be carried out at the municipal lighting plant in South Brooklyn.

COLUMBUS, OHIO.—The Central Ohio Traction Company, with a capital stock of $5,000,000, has been formed by W. T. Young, B. M. Jennings, D. F. Swanson and others of New York. According to newspaper interviews these people contemplate the building of an extensive system of electric railway in central and northern Ohio. It is claimed that one line will extend from Lorain to Columbus with a branch to Cleveland. Another branch will extend to Canton, Youngstown and Pittsburg.

STROUD, OKLA.—The proposition to bond the town for $4,000 for the construction of an electric light plant will be submitted to the people.

WATONGA, OKLA.—This city will receive bids until February 9 for furnishing material for, and constructing complete, an electric light plant and water main extensions. Bids will be received on each item and on the work as a whole. There will be required pipe, dynamo, hydrants, steam engine, lamps, meters, poles, wire, boilers, feed pump, heater, etc. Address M. A. Earl, Consulting Engineer, Muskogee, Ind. Ter.

SANGER, ORE.—At a recent meeting held in Pendleton, the Eagle River Electric Power Company elected the following named officers: President, F. W. Paine, of Baker City; vice-president, Dr. J. E. Bingham, of Walla Walla, Wash.; secretary and manager, J. K. Roming, of Baker City. It is the intention of the company to establish a power system on Eagle River, near Sanger. The capital stock is placed at $500,000.

TECUMSEH, OKLA.—Prof. F. Perrine, who has been investigating the feasibility of an electric railway between Tecumseh and Shawnee, has reported favorably to the Shawnee Lighting Company, which proposes to build the line. Dennis T. Flynn is president of the company, which is owned largely by Eastern capital. If the interurban plans are approved, it is stated that the company will also purchase the property of the Shawnee Traction Company which is now in the hands of a receiver.

PORTLAND, ORE.—The Portland General Electric Company contemplates making improvements in this city to the extent of $1,000,000. These improvements will include the erection of an office building at 7th and Adler Streets, to cost $200,000, a distributing plant from which power for the lighting and car service for the entire East Side will be supplied, and a sub-station at Sellwood to receive power from the plant on the

Clackamas; also the installation of new equipment, including 1200 street lamps to take the place of those now in use.

PINEGROVE, PA.—The citizens will vote at the election to be held in February on the proposition to issue bonds for the purpose of erecting an electric light and power plant at a cost of about $8,000. The power will be derived from the water works, erected by the borough ten years ago.

DELAWARE WATER GAP, PA.—C. J. Young, of Philadelphia, is engineer for the Delaware Water Gap Power Company, which proposes constructing a power plant at this point. A dam will be put across Brodheads Creek and it is proposed to tunnel through the mountain and form a lake in Cherry Valley. A canal will also be built. It is estimated that from 2,500 to 7,200 horse-power can be developed here, and the work of construction will cost about $800,000.

PROVIDENCE, R. I.—A deed filed at the Town Clerk's office in East Providence shows that another strip of land on Pawtucket Avenue has been purchased by the Rhode Island Company for the purpose of installing a second track along that stretch of roadway beyond St. Mary's Seminary and extending to the switch or resumption of double tracking at the Ponham Club grounds.

BERESFORD, S. D.—The electric light plant, owned by A. B. Mason, was destroyed by fire on December 30.

BERESFORD, S. D.—Fire destroyed the Beresford electric light plant, owned by M. M. Doyle & Son. The city is without other public lighting facilities.

PIERRE, S. D.—An interesting source of power is about to be developed here, the city having decided to put in an incandescent electric light plant to be driven by waste water from the artesian wells. Tests show that this water coming under pressure will develop more than enough power to operate such a plant.

PIERRE, S. D.—Ordinances have been introduced in the City Councils of Pierre and Fort Pierre, on the west side of the Missouri River, for an electric street railway franchise to be granted to Noah Newbanks, of this city, and Frank Fischer, of Fort Pierre. The proposed line calls for about ten miles of trackage and is intended to give the towns joint service with local service for each of them. It is the intention of the parties interested to begin work in the spring if they can complete their arrangements by that time.

PULASKI, TENN.—The Mayor and Board of Aldermen have contracted with the Fort Wayne Electric Supply Company to install an electric light plant.

GIDDINGS, TEX.—Local parties are discussing the installation of an electric lighting plant.

RISING STAR, TEX.—The Rising Star Electric Light Company has been incorporated with a capital of $10,000, by H. E. Anderson and W. A. McSpadden.

VERGENNES, VT.—The construction of an electric railway from Vergennes to Fair Haven by way of Whitehall, N. Y., was the subject of discussion at a meeting held here recently, which was attended by about 100 representatives from the town through which the road would pass. A resolution, presented by R. W. McCuen, favoring the organization of a stock company to agitate the project and construct the road was unanimously adopted.

WAITSBURG, WASH.—Roberts & Henderson, owners of the electric light plant, contemplate enlarging the plant and extending the service to Prescott, Wash.

WALLA WALLA, WASH.—R. E. Allen, assistant secretary of the Northwestern Gas & Electric Company, writes that it has been decided to increase the capital stock of the company.

SEATTLE, WASH.—The Kern-Rand Company has been incorporated with a capital of $25,000, to sell and rent water and electric power. The company's principal place of business will be in this city, with a branch office at Los Angeles, Cal.

POST FALLS, WASH.—The Washington Water Power Company, it is said, has taken over the contract of Bennett & Bihler and will complete the extensive improvements the company is making here in connection with its large power plant.

ELLENSBURG, WASH.—The organization of the Ellensburg Traction Company has been practically effected. It will haul sugar beets to the dump for a radius of ten miles. It has contracted to haul the product of the 10,000 acres that will be planted by the growers' association.

PULLMAN, WASH.—The Moscow Electric Light Company, of Moscow, Ida., has secured a 20-year franchise in Pullman, subject to the vote of the citizens. The contract provides that the company shall purchase the plant owned by the city. Mr. M. J. Shields, of Moscow, is president of the company.

SEATTLE, WASH.—Articles of incorporation have been filed with the County Auditor by the Hanford Irrigation & Power Company, having a capital stock of $250,000. Among the incorporators are E. S. McCord, C. J. Smith and M. B. Haynes. The company intends engaging in a general irrigating and electrical power business, with headquarters in this city.

DANVILLE, W. VA.—The Danville Improvement Company proposes in the near future to install water works and an electric light plant. H. L. Carter is secretary and treasurer of the company.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has decided to issue bonds to the amount of $20,000,000 to be used in making improvements and extensions and for refunding purposes.

CRANBROOK, B. C.—The East Kootenay Power & Light Company has been incorporated with a capital of $250,000, and will develop a water power on the St. Marys River.

PICTON, ONT.—The citizens have voted to issue $15,000 bonds for installing a new street lighting system.

BOBCAYGEON, ONT.—The citizens have voted to appropriate $25,000 for the purchase of M. Boyd Company's water power and to establish an electric light plant for the village.

PORT ARTHUR, ONT.—The taxpayers have endorsed a by-law approving the expenditure of $7,000 for improvements to the municipal power plant, and also one providing for the appropriation of $14,000 to be expended in completing the electric lighting system.

WELLANDPORT, ONT.—James A. Ross, of this place, will apply to Parliament for the incorporation of a company to build on electrical railway from Port Maitland, on Lake Erie, to Beausville on Lake Ontario. Others interested are S. D. Lake, of St. Catharines, and George Arnold, of Ridgeville.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Railway Company is seeking authority to make extensions from Thorwold to Port Colborne, Fort Erie to Niagara Falls, from Niagara Falls to Niagara-on-the-Lake, from Niagara Falls, Thorold or Welland to Brantford, from St. Catharines to Niagara-on-the-Lake.

## New Industrial Companies.

THE WOODS ELECTRICAL COMPANY, Houston, Tex., has been incorporated with a capital of $50,000.

THE HILL-WRIGHT ELECTRIC COMPANY, Newark, N. J., has been incorporated with a capital of $6,000, by Franklin T. Hill, Emeline Wright and Alfred A. Wright.

THE REDD & VOLK ELECTRIC COMPANY, Norwalk, Conn., has been incorporated with a capital of $19,000, for the purpose of conducting an electrical supply business.

THE MODERN INSULATOR COMPANY, San Francisco, Cal., has been incorporated with a capital stock of $100,000, by John Moss, R. A Falkenberg, S. S. Simon, E. F. Bert and Augustus Waterman.

WESTERN ELECTRIC COMPANY, Indianapolis, Ind., has been incorporated with a capital stock of $50,000, and will buy and sell electrical goods, etc. Charles G. DuBois and F. W. Bennis are interested in the new company.

EASTERN ELECTRIC LAMP COMPANY, New York, N. Y., has been incorporated, with a capital of $5,000, for the manufacture of electric lamps, etc. Morris Leight, Maurice J. Katz and Edward Dinkelspiel are named as the directors.

THE ELECTRIC CABLE COMPANY, Bridgeport, Conn., has filed a certificate of incorporation. It has an authorized capital stock of $500,000 and its incorporators are Edwin W. Moore ,of New York; F. H. Cowles, of Greenwich, Conn., and J. N. Shreve, of Scarsdale, N. Y.

THE FAIRBURY TELEPHONE COMPANY, Fairbury, Ill., having a capital of $20,000, has been organized and articles of incorporation filed. The company is composed of George C. Monk, Charles E. Monk and E. A. Agard, and will carry a stock of telephone service supplies.

THE GENERAL MANUFACTURING & SUPPLY COMPANY, Camden, N. J., has been incorporated by John A. McPeak, F. R. Hansell and George H. B. Martin. The company has a capital of $250,000 and will engage in the manufacture of lamps, globes, gas and electric fixtures, etc.

THE SCOTT ELECTRICAL EQUIPMENT COMPANY has been organized at Portland, Me., for the purpose of manufacturing and dealing in electric motors, machinery, instruments and electrical devices of all kinds. Officers: President, Millard W. Baldwin, of Portland; treasurer, James J. Hernan, of Portland.

THE GORDON MANUFACTURING COMPANY, Chicago, Ill., has been incorporated for the purpose of manufacturing electrical and mechanical appliances. Those interested in the concern are Gordon G. Burdick, Charles Ford and Alvena L. Burdick. The company has a capital stock of $2,500.

## Obituary.

DR. OTTO A. MOSES.—We regret to note that Dr. Otto A. Moses, electrical expert, geologist, chemist and inventor, prominently identified with many Hebrew charities, died on Wednesday, January 3, of œdema of the lungs, followed by erysipelas. He was a son of Aaron J. Moses, of Charleston, S. C., where he was born in 1846. He was graduated from the University of Leipsic. On his return be became State Geologist of South Carolina. Coming to New York about thirty years ago, he entered business as a mechanical engineer and electrical expert. He was associated in early life with Mr. Thomas A. Edison. In 1880 he represented Mr. Edison in Paris at the electrical exposition. Later he was connected with the Westinghouse Electric Company, and was one of the earliest advocates of the adoption of the alternating-current system in this country. He was a founder of the Hebrew Technical Institute, and was also associated with the Montifiore Home and the Hebrew Benevolent Orphan Asylum. He leaves two sons, one of whom is Walter Florian, a painter, and a daughter. The other son, Julian, is a rising young electrical engineer. A portrait of his father by Walter Florian appeared in the exhibition of the National Academy of Design last year.

## Personal.

MR. J. H. ASHBEY, of New Orleans, La., has been appointed local selling agent there for the line of materials of Albert & J. M. Anderson Manufacturing Company, of Boston, Mass.

MR. HENRY L. DOHERTY, the electrical central station manager and expert, is also very prominent in the gas field and has just organized in New York city the Gas Securities Company, to promote gas and electric operating companies, with a capital of $1,000,000.

MR. W. B. ELLISON has been appointed by Mayor McClellan Commissioner of Water, Gas and Electricity for New York, succeeding Mr. Oakley. Mr. William C. Cozier, of the New York *Sun*, has been appointed Deputy Commissioner for the Borough of Brooklyn.

MR. JOHN M. BRUCE, of Bruce & Johnston, 42 Broadway, New York City, publicity experts, has taken into partnership Mr. Kendall Banning, who until recently was managing editor of "System." Mr. R. H. Johnston has retired from the firm in order to devote his entire time to automobile advertising.

MAJOR G. O. SQUIER, U. S. A., of the Signal Corps, stationed at Leavenworth, Kan., was a recent visitor to New York City, after an absence of many months. As noted in these columns, the Signal Corps is conducting special courses in wireless telegraphy, etc., at the army training college at Leavenworth, and is also carrying on some very interesting and successful experimental work.

MR. S. C. SCHENCK, who has been connected with the New York office of the Westinghouse Electric & Mfg. Company in its street railway detail department, has resigned his position to accept the position of general manager of the Sterling Varnish Company, of Pittsburgh, Pa. He will be located permanently in Pittsburgh and will be happy to see and to receive any of his old friends in the electrical field at any time.

MR. C. A. COFFIN, president of the General Electric Company, accompanied by members of his family, sailed on the White Star liner, "Celtic," on Saturday, January 6, for the Mediterranean cruise, landing in Egypt, where he proposes to spend a few months of hardly-won rest and recreation. There is said to be a possibility that Mr. Coffin may extend the trip, as the last few years of tremendous electrical development have deprived him practically of all opportunity of a long vacation until now.

MR. B. K. HOUGH has been appointed New York representative of the Mayer & Englund Co., of Philadelphia, succeeding the late Mr. Beach, whose death was recently noted. Mr. Hough was graduated from Cornell in 1897, after which he became associated with the Boston Electric Light Co., and Stone & Webster, for a period of four years. In 1901 he came to New York City as sales engineer for the local office of the Stanley Electric Co., later occupying the position of chief sales engineer of the company. More recently he has been connected with the New York Edison Co. and Ford, Bacon & Davis.

## News of the Trade.

THE NATIONAL SWITCHBOARD COMPANY, New York, announces the removal of its factory and office to the northeast corner of 58th Street and 11th Avenue, New York, the premises formerly occupied by the Switchboard Manufacturing Company, where the two shops have been combined and will be operated by the National Switchboard Company.

BIJUR BATTERIES.—At the coming Chicago Electrical Trades Exhibition, the General Storage Battery Company will show, in addition to a full line of Bijur "High-Duty" plates and batteries, a working booster system handling violently fluctuating loads while maintaining a steady load on the generator. This is accomplished by a "Bijur" automatic regulator working on a new principle with striking results.

SHEAFF & JAASTAD, the well-known consulting engineers in the mechanical and electrical field, with headquarters, Boston, Mass., have moved into new offices in the Broad-Exchange Building there—not the building of same name in New York as previously reported. In their new home they will have much larger and better space and facilities for their draughting rooms. Their offices are located on the top floor, allowing much more effective light in the day.

DEAN ELECTRIC COMPANY, Elyria, Ohio, has been authorized to increase its capital stock from $300,000 to $1,000,000. For the present only $150,000 of the new stock will be issued. The new stock is being offered to the present stockholders on the basis of par to the extent of one-half their present holdings. The increase of capital is made necessary by the rapid growth of this institution. A large part will be employed as working capital, although some improvements in the way of buildings and equipment are in contemplation.

DOUBLEDAY-HILL ELECTRIC CO.—The manufacturing and repair department of the Doubleday-Hill Electric Co., Pittsburg, has grown to such large proportions, that it has been found necessary to devote the entire top floor of the company's building to the work of this department. Mr. F. J. Lindeman, who was formerly connected with the winding department of the Westinghouse Company, has accepted the position of manager of this important department. Under his supervision new machinery has been installed, so that the department is fully equipped to do all kinds of repair work in a most satisfactory and prompt manner. Armatures and other parts of electrical machinery can be repaired, irrespective of the particular make of machines. This point is of especial advantage to central stations and other electrical plants whose equipment consists of machinery made by a number of different manufacturers. An entirely new departure in the construction of armature and magnet coils is the fireproof and indestructible type which the Doubleday-Hill Co. is now putting on the market. These coils, it is said, cannot be burned out or destroyed by even careless usage.

# Weekly Record of Electrical Patents.

U. S. PATENTS ISSUED FOR WEEK ENDING JAN. 2, 1906.
[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

808,641. WIRELESS TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed May 14, 1903. A system for detecting wireless emanations. The impulses are received through a vibrating contact, which thereby varies the resistance and qualities of resonance of the receiving circuit.

808,642. TELEGRAPHIC KEYBOARD APPARATUS; Patrick B. Delany, South Orange, N. J. App. filed Apr. 11, 1904. Typewriter keys are furnished with sliding rack sections thereon which are depressed into contact with a continuously rotating pinion which serves to draw the depressed rack sections forwardly and make the required contacts against a fixed blade or brush.

808,669. TABLET-BOARD; Charles B. MacFarlane, Waltham, Mass. App. filed Feb. 28, 1905. Can be used either as a two-wire or three-wire panel board. A pair of bus bars is connected with two of the terminals and a bus bar on the opposite side of the tablet connects with the other terminal.

808,717. ELECTRIC LOCOMOTIVE; Asa F. Batchelder, Schenectady, N. Y. App. filed Nov. 12, 1903. The frame of the truck on which the superstructure is mounted is utilized as the field-magnet structure for the propelling-motors.

808,718. REGULATING TRANSFORMER; Henry J. Blakeslee, Hartford, Conn. App. filed April 8, 1905. The transformer has only stationary coils and a magnetic circuit of constant reluctance so arranged that the total magnetic flux is at all times inclosed by one coil, while from the minimum to the maximum flux is inclosed by the other coil automatically, or at will, according to the requireed conditions.

808,723. ANNUNCIATOR; Albert Carliss, Chicago, Ill. App. filed May 25, 1901. A drop or shutter is combined with a pivot pin having a central upward bend. A lever to actuate the drop or shutter extends beneath the upward bend.

808,729. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Maxwell W. Day, Schenectady, N. Y. App. filed May 15, 1905. The series winding of a compound-wound motor is divided into halves, which when the motor is hoisting assist the shunt winding to excite the field. When the motor is lowering a light load the windings oppose each other, but in the aggregate assist the shunt winding, and when the motor is overhauled by the load and becomes a generator the series windings assist the shunt-winding.

808,740. TRANSFORMER; John J. Frank, Schenectady, N. Y. App. filed March 27, 1905. The transformer core is formed of three main sections, each comprising two or more groups of laminæ. The laminæ in each of the different bundles are successively displaced so that each bundle is an oblique prism. The opening through the body is not straight but is inclined at an angle to another portion. The length of turn of conductor is thereby reduced.

808,753. VAPOR ELECTRIC APPARATUS; Alexander M. Jackson, Schenectady N. Y. App. filed June 24, 1904. In connection with the usual mercury vapor apparatus, the non-volatizable anode is hollowed and surrounded with a body of mercury. A high-resistance material is arranged to connect electrically the two electrodes before the starting operation takes place; this is cut out when the apparatus is in operation.

808,755. ELECTRICAL BATTERY; Carl Jäger, Rock Island, Ill. App. filed Feb. 27, 1904. A dry cell with a zinc cup and a carbon pencil, the latter being surrounded by a compound of manganese dioxide, iron-filings and powdered graphite, with a filling of flour and plaster-of-paris between cup and pencil.

808,773. SURFACE CONTACT ELECTRIC RAILWAY; George H. McFeaters, Johnstown, Pa. App. filed Aug. 15, 1904. Relates to details of construction of a circuit closing shoe for railways employing spaced contact plates. The movable contact is carried by a flexible conductor, and an insulating diaphragm prevents arcing from points on flexible conductor.

808,774. PIANO PLAYING ATTACHMENT; Hugh McPhail, Visalia, Cal. App. filed Apr. 18, 1903. The usual continuously moving perforated band has spring contacts bearing there against, which complete the circuits of power magnets for the individual notes or keys. The magnets are energized with varying strength depending on the composition played.

808,777. TELEGRAPH KEY; Addison E. Peterman, Repton, Ala. App. filed Oct. 13, 1905. The telegraph key is supported on a "turn-table" so as to automatically make contact with different transmitting circuits when moved to different angular positions.

808,778. MOTOR CONTROL SYSTEM; William B. Potter, Schenectady, N. Y. App. filed Aug. 10, 1904. Relates to a system of operating trolley cars from 500-volt circuits, and high potential alternating circuits at different times. Transformers are employed for stepping down the high potential to about 200 volts, at which it may be utilized on the ordinary series motor.

808,779. ELECTRIC GENERATOR; Benjamin P. Remy and Frank I. Remy, Anderson, Ind. App. filed May 27, 1905. A magneto-generator having supplemental pole pieces soldered into the form of a tube concentric with the usual pole faces. In this way they are rotarily adjustable so as to vary the time of the spark.

808,798. APPARATUS FOR THE AGITATION OF SOLUTIONS USED IN ELECTRODEPOSITION OF METALS; William Charles Wood and Bertie Oaksford, London, Eng. App. filed Aug. 31, 1905. The bottom of the tank contains troughs in which perforated plungers slide up and down and thus produce circulation of the electrolyte.

808,832. RECEIVER AND RECORDER FOR WIRELESS AND OTHER TRANSMISSIONS; Fred E. Gallagher, San Francisco, Cal. App. filed June 15, 1905. A printing telegraph arrangement in which a motor rotated printing wheel is stepped around by a magnet controlled escapement established by the local receiving circuit.

808,834. RELAY; Charles Lane Goodrum, Rochester, N. Y. App. filed Nov. 11, 1905. Details relating to the mechanical arrangement of parts.

808,849. METHOD OF TREATING MOLTEN MATTE; Walter E. Koch, Pittsburg, Pa. App. filed Feb. 19, 1903. The molten matte passes slowly along an inclined trough between a series of hollow electrodes through which water gas is blown into the matte, the sulphur being thereby removed. With a copper-iron matte the electrolytic action causes the iron to be drawn to one electrode and the copper to the other one, so that at least partial separation of the metals is obtained.

808,852. TROLLEY DEVICE; Frank J. Ludolph, Rochester, N. Y. App. filed July 18, 1905. The spokes of the trolley wheel are formed by stud bolts which can be screwed inward so as to remove and replace the tread portion of the wheel. An additional feature relates to the journal boxes or bearings, which are in two parts and adjustable for wear.

808,868. TELEPHONE SIGNALING APPARATUS; Karl H. Poyas, Los Angeles, Cal. App. filed July 24, 1905. Two normally-closed manually operated make-and-break switches are mounted on the base of a telephone receiver, and form a part of the instrument circuit. A ground plate is secured to the base at a point to be engaged by the switches when they are moved to open the circuit.

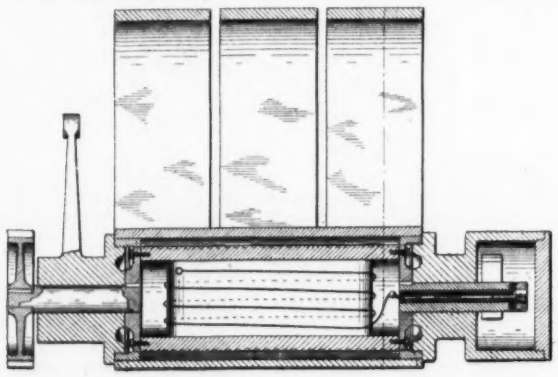
808,882. LIGHTNING ARRESTER; Frederick A. Stafford, Chariton, Iowa. App. filed April 3, 1905. Designed for telephone use. Excessive current bridges the space between two plates and escapes to ground. Switches are provided for connecting the contact plates and also the ground plates and the contact plates.

808,929. AUTOMATIC GAS DANGER SIGNAL; Preston A. Kettering, Cadiz, O. App. filed May 31, 1904. The gas burner has a piston which is spring pressed to close the pipe and only opened by the gas pressure therein. The movements of the piston establish an alarm circuit to indicate when the gas is turned off.

808,944. ALTERNATING-CURRENT-MOTOR REVERSER; Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. App. filed Mar. 29, 1905. In the circuit to be reversed two equal opposing electromotive forces in series are provided. By weakening either one of the electromotive forces or short-circuiting it entirely the other e. m. f. is left to supply the circuit in the desired direction.

808,597. CIRCUIT CONTROLLER; Richard Varley, Englewood, N. J. App. filed Oct. 31, 1904. An arrangement to secure a constant energy in the ignition spark regardless of whether the engine is moving fast or slow. Ordinarily the circuit closure is for a smaller time in case of high engine speeds, but the patentee overcomes the difficulty by having the vibrator worked by a magnetic pole of predetermined strength, which gives a uniform actuation under all circumstances.

808,958. SPARK-IGNITION SYSTEM FOR EXPLOSIVE-ENGINES; Richard Varley, Englewood, N. J. App. filed Mar. 28, 1905. A system



808,779.—Electric Generator.

to give a single spark in case of low engine speeds and a torrent of sparks at high speeds. The operating cam has a low part with a comparatively high projecting terminal. The low part is effective to close the ignition circuit directly through the primary so as to give a single spark, while the high projecting terminal closes the ignition circuit through a vibrator at high speeds. In this way the number of sparks is made to accord to the needs and requisites of the system.

809,060. RINGER FOR TELEPHONES AND THE LIKE; Elbert Radolph Hobbs, Lamar, Col. App. filed Nov. 10, 1904. The mechanism, which is connected with a supporting plate and adjusted relatively thereto, is provided with brackets to which springs are connected. The armature is mounted on these springs, and is free to rock by the resilience thereof.

809,083. AUTOMATIC ELECTRICAL CONTROLLER FOR AIR COMPRESSORS; Fred D. Ackerman, Kendallville, Ind. App. filed May 17, 195. Details of a system having a pressure controlled piston or diaphragm directly connected to the switch for the compressor motor.

809,085. ELECTROLYTIC APPARATUS; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed July 22, 1903. By the electrolysis of fused sodium chloride a lead-sodium alloy is produced, which is displaced by gravity and associated with a metal hydroxide. The resulting sodium oxide is removed and exposed to the action of steam and a portion of the sodium hydroxide, thus produced, is returned to the chamber containing the lead-sodium alloy.

809,088. PROCESS OF PRODUCING CAUSTIC ALKALI; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed May 10, 1905. Covers the process for which the apparatus is patented in 809,085.

809,089. PROCESS OF MAKING CAUSTIC ALKALI; Henry Spencer Blackmore, Mount Vernon, N. Y. App. filed May 10, 1905. An aqueous solution of sodium chloride is electrolyzed with a mercury cathode. The sodium amalgam formed is caused to overflow into a separate oxidizing cell through carbon tetrachloride, whereby the metallic contact of the mercury in the two cells is broken. The mercury from which the solution is separated by electrolytic oxidaton in the oxidizing cell, flows off by gravity and is then returned to the sodium chloride cell.

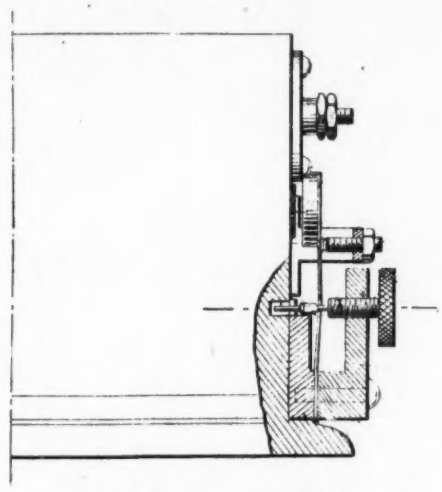
809,116. METHOD OF PRODUCING CIRCULATION IN ELECTROLYTIC PROCESSES; Hugo Koller, Vienna, Austria-Hungary, and Paul Askensay, Nuremburg, Germany. App. filed Oct. 29, 1903. In a diaphragm cell the elecrolyte is caused to flow toward and into the cathode compartment in a direction at right angles to the lines of diffusion.

809,120. ELECTRIC RAILWAY. Charles Levinson, New York, N. Y. App. filed July 18, 1905. A safety device for preventing the starting of a train of cars prematurely, which consists in locating a plurality of switches in the driving motor circuit of every car of the train, said switches being operated by the gates.

809,126. ELECTRIC-LIGHT-FIXTURE INSULATOR; Louis McCarthy, Boston, Mass. App. filed Feb. 2, 1905. An insulator for the ordinary canopy used with electric-light fixtures. A ring of insulating material is provided with two ribs, the inner one being higher than the outer one, and the canopy is set in the depression between the ribs.

809,183. CURRENT-TAP; William D. Harris, Philadelphia, Pa. App. filed Mar. 24, 1905. A combined plug and socket having means for the convenient attachment of conductors whereby electrical energy may be delivered to any desired apparatus.

809,186. TELEPHONE SYSTEM; Henry A. Judge, Washington, D. C. App. filed Sept. 9, 1905. In series with the battery and the transmit-



809,235.—Induction Coil Vibrator.

ter is an electro-magnet of low ohmic resistance, around which is placed a shunt so arranged as to be practically opaque to continuous currents but transparent to periodic currents.

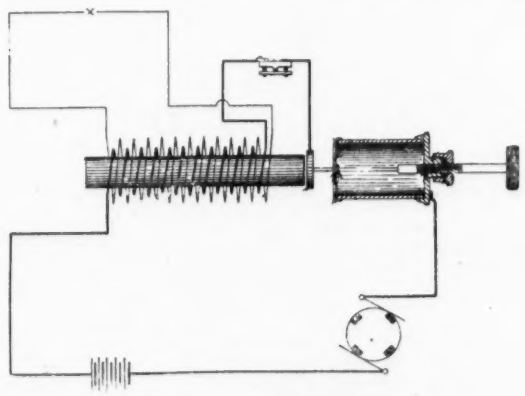
809,220. COLLECTOR-RING; Henry G. Reist, Schenectady, N. Y. App. filed Apr. 22, 1904. A form of collector-ring and means for securing it so that it will not work loose under the stress of operating conditions. The ring is cut away to form a flexible part and supporting studs to engage and hold the flexible portions under tension.

809,226. WIRE CARRIER; Frank L. Sessions, Columbus, Ohio. App. filed July 17, 1902. The hanger has pivoted clamping levers thereon which engage the wire sections and tighten them into alignment with one another when the clamping levers are spread apart.

809,232. SEMI-AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Arthur T. M. Thomson, London, England. App. fild Oct. 6, 1905. A subscriber's latent-signal set includes a signal-transmitter arranged to send signals in groups with a prolonged current change between the groups.

809,235. INDUCTION-COIL VIBRATOR; Richard Varley, Englewood, N. J. App. filed Feb. 25, 1905. In order to provide means for regulating the tension of the spring vibrator of an induction coil, which shall insure a uniform tension or strain for any adjustment, which shall permit the insertion and removal of the tongue without varying its tension, and which shall preclude overstraining the tongue beyond its elastic limit, the patentee makes use of a special construction having a rectilinearly guided yoke with a threaded stem adjustable to and fro by a left-handed screw.

809,236. ELECTRO-MAGNETIC SWITCH SETTING APPARATUS AND ELECTRIC RAIL HEATER; Bruno O. Wagner, Swissvale, Pa.



809,261.—Contact Device for Induction Apparatus.

App. filed Mar. 9, 1905. The switch rod projects into a casing in which is contained a plurality of iron-clad magnets supported so as to reciprocate the rod and throw the switch point to its alternate positions.

809,237. SEMAPHORE MECHANISM; Bruno O. Wagner, Swissvale, Pa. App. filed Mar. 9, 1905. An enclosed motor having its armature directly secured to the semaphore arm. The armature circuit is made by fiexible leads from the walls of the casing.

809,262. CONTACT DEVICE FOR INDUCTION APPARATUS. Ralph O. Hood, Danvers, Mass. App. filed Apr. 11, 1905. A stem upon the usual vibrator of an induction coil projects through a flexible diaphragm into a hermetically closed box so that the free oxygen will be exhausted and the life of the contact points prolonged.

12,431. (Reissue.) INDUCTION MOTOR; Abe L. Cushman, Concord, N. H. App. filed Apr. 14, 1903. The secondary winding consists of several separate elements, one of which is connected in closed circuit star fashion, and means are provided for connecting other of the elements in parallel with the first as the rotor gains speed.